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[R]AILWAY LOCOMOTIVES AND CARS

MARCH 1953

...ND SUPERVISORS RESPONSIBLE FOR DESIGN, CONSTRUCTION AND MAINTENANCE OF MOTIVE POWER AND ROLLING STOCK

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MARCH, 1953

VOLUME 127

No. 3

RAILWAY LOCOMOTIVES AND CARS

Founded in 1832 as the American Rail-Road Journal.

Published monthly by Simmons-Boardman Publishing Corporation at 1309 Noble St., Philadelphia, Pa. Entered as second-class matter, January 16, 1953, at the Post Office at Philadelphia, Pa., under the act of March 3, 1879. Subscriptions payable in advance. Postage free. U. S., U. S. Possessions and Canada: *Railroad employees*—One year $2, Two years $3. *Other than railroad*—One year $4, Two years $7. Other countries in Western Hemisphere: One year $5, Two years $10. All other countries: One year $7, Two years $14. Single copies 50 cents. Address Robert G. Lewis, Asst. to Pres., 30 Church Street, New York 7.

Editorial and Executive Offices: 30 Church street, New York 7, and 79 W. Monroe street, Chicago 3. Branch offices: Terminal Tower, Cleveland 13; 1081 National Press bldg., Washington 4, D.C.; Terminal Sales bldg., Portland 5, Ore.; 1127 Wilshire blvd., Los Angeles 17, Cal.; 244 California St., San Francisco, Cal.; 2909 Maple avenue, Dallas 4, Tex.

Railway Locomotives and Cars is a member of the Associated Business Papers (A.B.P.) and the Audit Bureau of Circulation (A.B.C.) and is indexed by the Industrial Arts Index and also by the Engineering Index Service. Printed in U. S. A.

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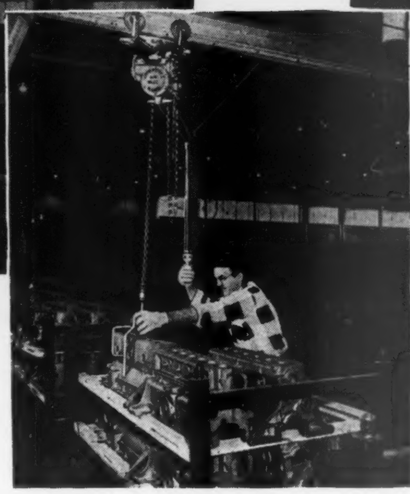

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Preparation Lags

When the hostilities in Korea began during the summer of 1950, the Class I railroads had an ownership of 1,724,088 freight cars of all types. The railroads, adopted a program at that time which was to build up the ownership to 1,850,000 freight cars. Had the contemplated production rate of 10,000 freight cars per month been attained within a few months and subsequently maintained, enough cars could probably have been built to have taken care of retirements and added enough new cars to the inventory to have reached the goal by the middle of this year. Actually, however, there were only 1,756,700 on the Class I railroads on the first of this year. If steel is available and enough car orders are placed the Association hopes to attain its goal by the end of next year.

During 1950 and 1951 the railroads carried out their part of the program. By March of 1951 there was a backlog of freight-car orders of 161,055. Meantime deliveries built up to an average of 7,600 a month during the first half of 1951 and increased to an average of 8,200 during the second half of the year. They reached 10,082 in October and since that time have been declining because of progresive cuts in steel allocations.

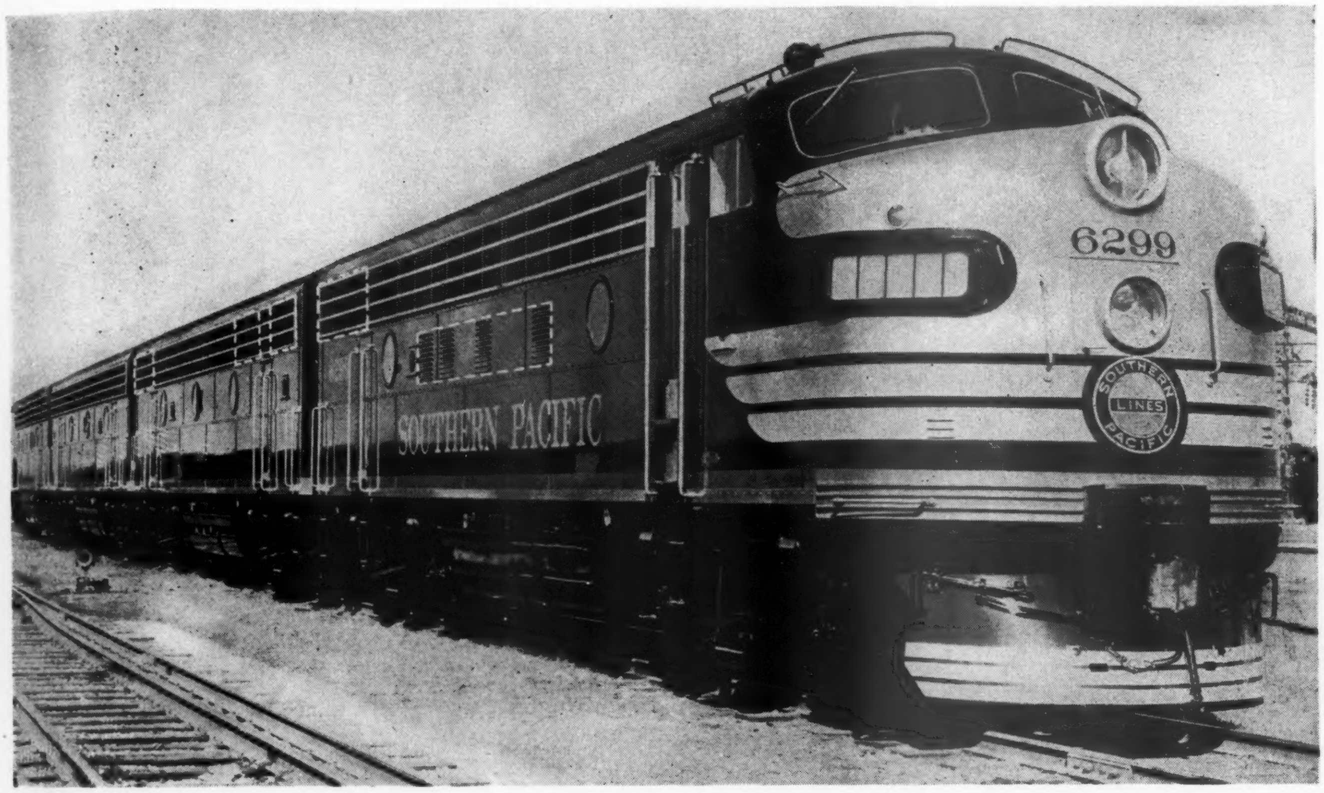
But with the decline in deliveries, orders for new freight cars also declined. By the beginning of 1952 the backlog was down to 123,000, and on February 1 it had shrunk to 77,400.

Discouraging as this situation is to those who feel a sense of responsibility for the development of a safe margin of transportation capacity to protect a national emergency, it is not entirely out of step with the course taken by the entire national program of preparation. Original objectives of 1950 have been modified and set back by about a year in the interest of less disturbance to normal civilian production activities. This has had the unfortunate effect of dulling the acuteness of the sense of national danger and inducing a slackening of effort all along the line.

The immediate outlook is for less severe curtailment of steel supplies by the government production administrative agencies during 1953. This, however, is not complete assurance that the car builders will receive all the steel necessary to carry out the full program contemplated by allocations. The probability of full supplies from the steel industry would be increased if the backlog of car orders were to cease the decline of the past year and, better yet, to show an upward trend.

One consideration is of great importance in the present situation. The disposition to let preparation for the emergency wait until it is upon the nation will inevitably delay full mobilization. So far as freight cars are concerned, it is only necessary to look back at World War II to see that, when the need for maximum transportation capacity materializes, there will be no steel for freight cars. If adequate car capacity is to be available, it must be built up now. This calls for car orders and for the steel to fill them.

C B Peck



EMD diesel freight locomotive equipped with 16 car-body air filters and four engine air filters in each power unit. Dotted sections show location of filters.

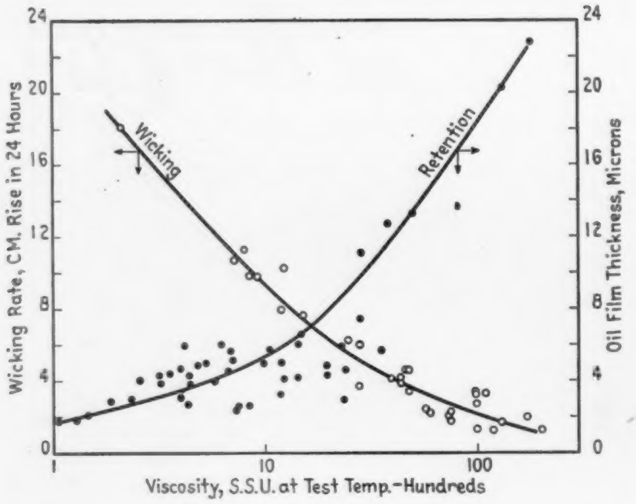
Air Filter Adhesive Developed In Laboratory and Field Tests

Diesel-engine filtration study a cooperative project of Southern Pacific, Farr Co., and California Research Corp.

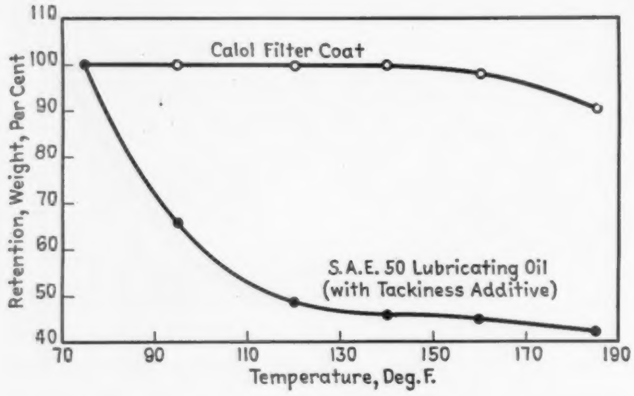
In a cooperative test program, the Southern Pacific test department investigated air filter maintenance and service factors; the filter manufacturer, the Farr Company, supplied technical aid and the use of their laboratory wind tunnel testing equipment; and the California Research Corporation investigated requirements of the material used as air filter adhesive. The results of this work, including laboratory and field test data presented below, were described in detail at the October 24, 1952, meeting of the Pacific Railway Club by A. W. Hardy, assistant director of research for Farr; B. F. Kline, chief chemist, S. P.; and F. J. Hanly, research engineer for the California Corporation.

The complexity of the problem of supplying clean air to a Diesel locomotive engine can be appreciated from a review of the requirements for air filters in this service. For example, one Electro-Motive Division (EMD) Type F-7 freight locomotive engine requires 2½ million cu. ft. of combustion and scavenging air for eight hours of full load operation. Additional clean air must be supplied to the engine room for the air compressor and for cooling electrical equipment. The space available for air cleaning equipment is extremely limited, and large volumes of air must be moved through restricted spaces (which means high air velocities) as pressure losses, including the air cleaner, not to exceed a small fraction of one inch of water.

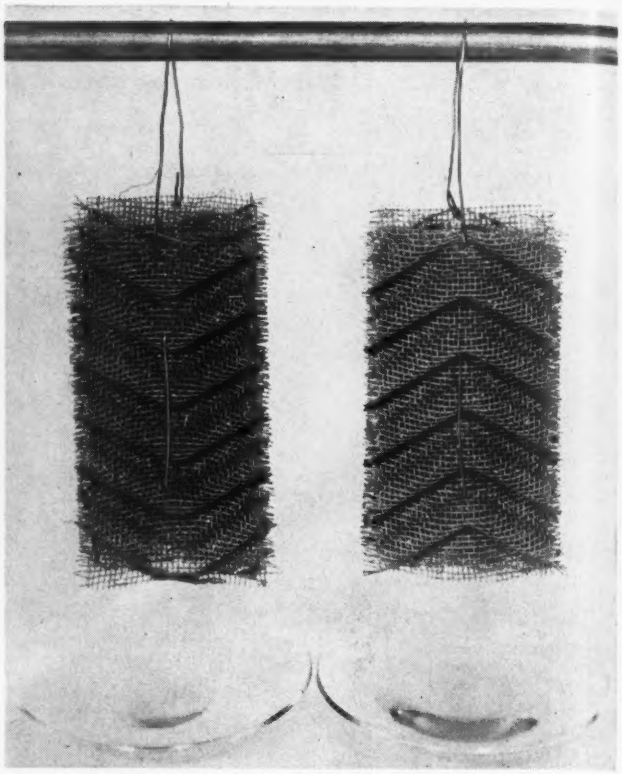
The air filter must function at sustained high efficiency



Wicking and tetention tests of air-filter oils—Farr Company test data.



Filter adhesives retention upon filter screen at various temperatures—Two hours' storage at each temperature with equal weights of adhesives applied initially.



Adhesion test shows loss after two hours at 185 deg. F.—Calol filter coat (left), 9½ per cent; SAE 50 lubricating oil (right), 58 per cent.

over the full ambient air-temperature range encountered by the locomotive. The temperature changes rapidly when the locomotive enters a single-track tunnel where the limited clearance causes recycle of the exhaust gas through the air filters, raising their temperature appreciably in a few seconds. The filter is subject to continuous vibration and occasional severe shocks. It cannot be serviced in transit, but only at scheduled mileages which may be doubled in emergencies. The filters described below were designed to meet these requirements.

The EMD Type F-7 freight locomotives operated by the Southern Pacific are quipped with the Farr oil-wet impingement-type filters. There are 16 car-body filters and 4 engine air-intake filters per power unit. The car body filters are located as indicated in one of the illustrations. Air entering the engine for combustion passes first through the car-body filters and then through the intake filters mounted on the engine. The individual filters are 20-in. square by 2-in. thick.

The impingement-type air filter works on the fly-paper principle; i.e., the airborne dust particles must strike a wet surface to be caught. In practice, these filters generally consist of spaced fibers supported in a frame and coated by dipping with oil or some other viscous fluid (hence the term viscous-coated type filter). Wood, glass, wire, straw, and plastic fiber fillings are used for disposable types while the permanent cleanable type used in railroad, automotive, and industrial service employs metal fibers such as copper and aluminum wool and galvanized wire screen. The impingement-type filter as developed by the Farr Company employs herringbone crimped layers of galvanized wire screen. It provides air turbulence for high filtering efficiency over a wide range of particle sizes, low pressure drop at all reasonable dust loads, freedom from plugging, high dust-holding capacity through progressive loading of dust well into the body of the filter, and easy cleaning and recoating. The use of metal fibers assembled in a regular pattern and uniform spacing (as in screen) for the filter pack is necessary to obtain uniform filter pack density over the entire area of the filter in order to prevent air channeling. The extent to which these design features are utilized in service is determined by the properties of the filter adhesive. It is necessary then, at this point, to examine closely the requirements for the filter adhesive.

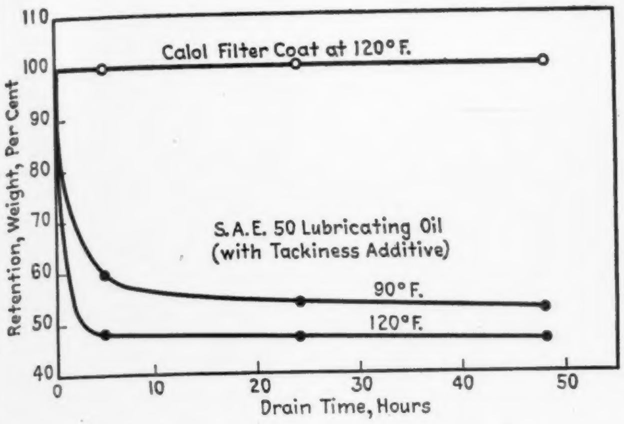
The Air-Filter Adhesive

The adhesive is the actual dust particle catching medium. The design of the filter determines the probability of a dust particle striking a surface as the air stream flows through the filter. The properties of the adhevise determine whether or not this particle will be retained by the filter. Accordingly, an investigation was made resulting in the following general specifications for the ideal impingment-type air filter adhesive.

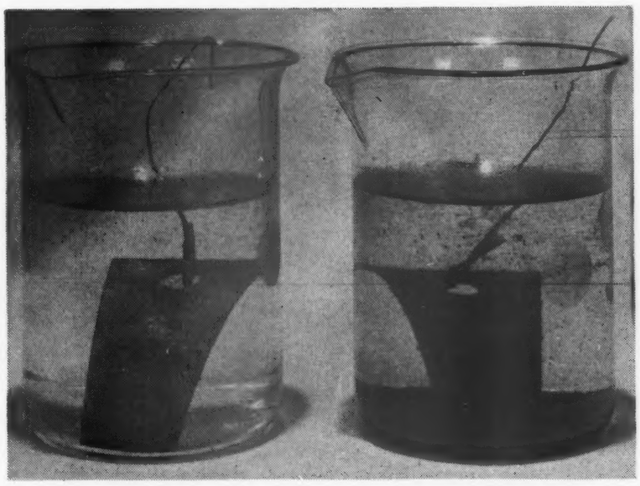
Application: Must be capable of uniform application in controlled amounts at a temperature not to exceed 200 deg. F in conventional filter processing equipment.

Wicking: Capable of wetting dust particles and wicking through successive layers of accumulating dust.

Retention: Remain without loss on solid fibers of the



Filter adhesives retention upon filter screen. Effect of drain time with equal weights of adhesives applied initially.



Adherence of filter adhesives to steel after 10 days' immersion in water. Calol filter coat (left); conventional filter oil (right) failed to prevent rusting.

filter without bridging between the fibers at operating air temperatures from sub-zero to 200 deg. F.

Stability: No separation, gelling, hardening, or permanent change in physical properties affecting service performance when held at 250 deg. F in contact with air for 500 hrs. or when subjected to temperatures cycling from subzero to 200 deg. F for 500 hrs. with at least one complete cycle every 24 hrs.

Odor: No strong or unpleasant odor of any kind at temperatures up to 250 deg. F.

Flast Point: 350 deg. F minimum for compliance with the Fire Insurance Underwriters' requirement.

Corrosion: Must not be corrosive or become corrosive in service to zinc, iron, and copper.

Water Resistance: Must be non-emulsifying and non-water-soluble to resist removal from the filter by rain and car washing sprays.

Removal For Filter Cleaning: Must be capable of rapid and complete removal from the air filter by conventional hot detergent wash or steam blast.

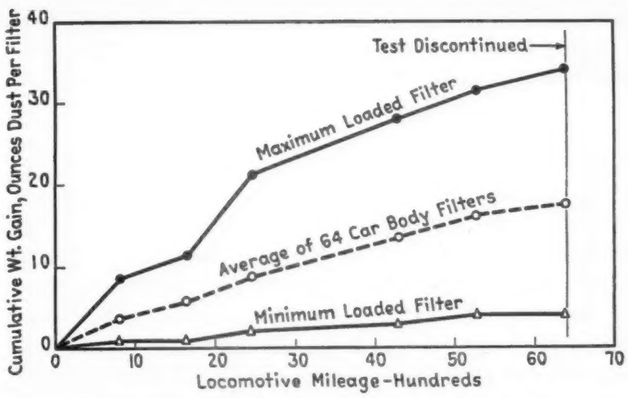
Bacteria: Must not support the growth of airborne organisms.

The oils formerly employed as air filter adhesives do not meet all of the above specifications and especially do not satisfy simultaneously the wicking and retention requirements which were found to be the most important of the specifications and hence will be discussed below.

Retention Versus Wicking

Straight and additive-type (tacky, etc.) petroleum oils have been used for many years as the "dust-catching medium" or "filter adhesive" on metal screen, glass wool, wood, and other fiber-filled air filters. The ability of oil to wet and hold dry dust particles as long as the oil film remains on the filter fibers in the path of the dust particles is well known. However, regular oils have the disadvantage of flowing continually under the force of gravity down and off the solid surfaces resulting in (1) essentially dry surfaces that cannot hold impinging dust particles, and (2) wasteful drainage which must be cleaned up.

The rate of oil drainage is a function of the viscosity of the oil. The higher the viscosity, the slower is the rate of drainage. If the temperature is raised, the viscosity of the oil decreases rapidly with corresponding increased rates of oil drainage. For example, an SAE 50 lubricating oil has about the same viscosity at 160 deg. F as a light



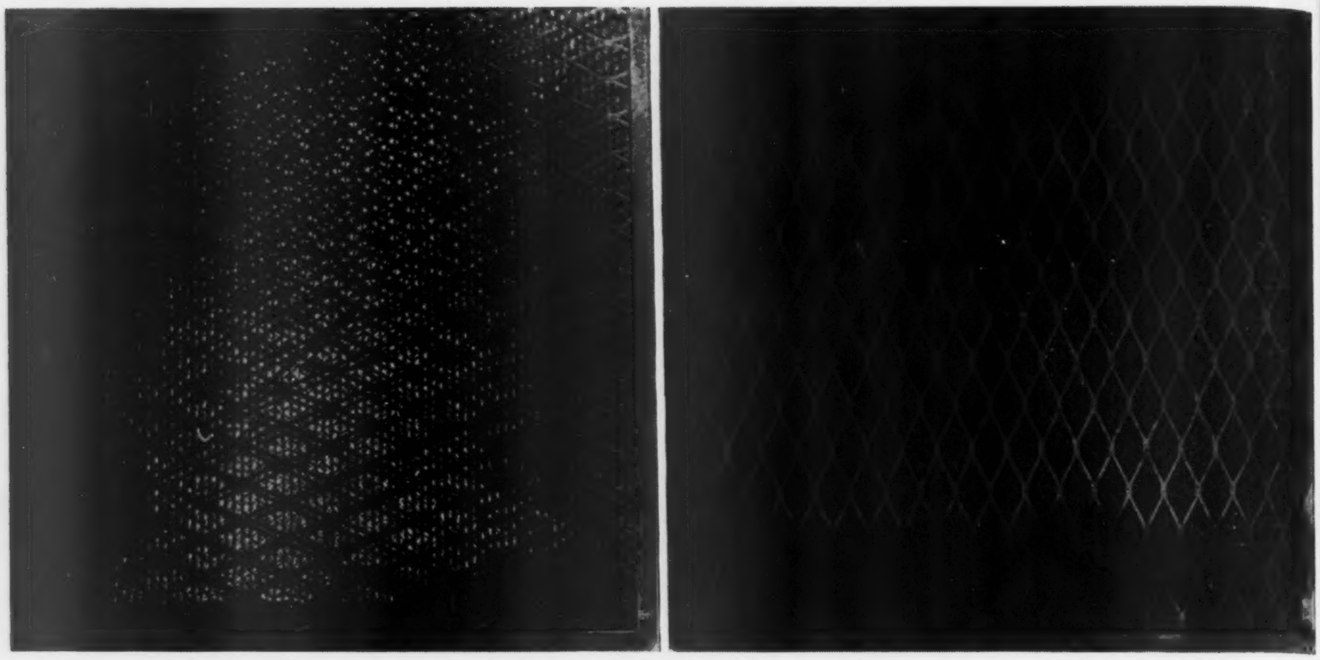
Progressive dust-loading curves show generally constant rate of increase up to the last 1,000 miles of the test when a heavy rain greatly reduced road dust.

machine oil at room temperature. The SAE 50 oil therefore drains off the filter at 160 deg. F as fast as the light machine oil does at room temperature.

In addition to remaining on the filter surfaces, the filter adhesive must "wick" through or wet the dust particles as fast as they are accumulated in order to present a continuously oily dust-catching surface. Unfortunately, this wicking property is also a function of the oil viscosity, but in an inverse manner; that is, the higher the viscosity of the oil, the lower is the rate of wicking. Thus, while a high viscosity oil is required for oil retention on the filter, a low viscosity is required for adequate wicking.

The practice has been to compromise these two conflicting requirements for an air filter adhesive in favor of the higher viscosity oils in order to secure maximum retention of oil on the filter media for the longest possible time at the expense of the wicking rate. The dust-catching efficiency of the filter then is limited by the wicking rate of the oil rather than by the mechanical design of the air filter. At high rates of dust loading, an oil of too high a viscosity can seriously impair the operation of the filter and allow passage of an intolerable quantity of dust.

For example, consider an air filter coated with an SAE 50 lubricating oil filtering air at 100 deg. F. If the air temperature rises to 150 deg. F, the rate of wicking



Relatively clean and well-oiled engine-air-intake filter (left) after 30-day 6,400-mile test period on locomotive, as compared with car-body filter which acquired 34-ounce dust load in the same period.

would be at least double, but the rate of drainage would be increased four times. If the air temperature drops to 50 deg. F, the "wicking" rate would be reduced to one fourth or less of its 100 deg. F rate although the oil would stay on the filter eight to ten times as long as at 100 deg. F. Thus, if the temperature drops much below the selected condition, the air filter becomes inefficient due to the low wicking rate of the filter adhesive, and if the temperature rises, the filter rapidly becomes inefficient because of loss of the dust-catching oil. Furthermore, at all temperatures above the pour point of the oil, it is draining continually down and off the air filter at a rate dependent upon the viscosity which in turn depends upon the air temperature.

The basic conflict in flow requirements for wicking and retention is shown in a chart wherein data accumulated on a wide variety of oils were plotted against the viscosity of the oil at the test temperature. These oils, which include white oils, aromatic and naphthenic lubricating oils, tackiness-compounded oils, and synthetic oils, performed strictly according to their viscosity and not according to their chemical composition.

It was found that a radically new filter adhesive combined these conflicting requirements into a single product which would also comply with the general specifications previously listed.

Air Filter Adhesive Development

Various formulations were subjected to separate tests to determine retention and wicking properties. Overall performance properties were then evaluated in the Farr Company's wind tunnel, and, finally, full-scale diesel freight locomotive service tests were made. Throughout these tests a regular SAE 50 grade lubricating oil with a tackiness additive was used as the standard of comparison as being representative of the most commonly used air filter adhesives. While several promising compositions were discovered, all but the one that finally emerged as Calol filter coat were eliminated before reaching the

PERCENTAGE ANALYSIS OF AIR FILTER DIRT SAMPLES (RESIDUE AFTER SOLVENT WASHING OF FILTERS)

	Body filter	Engine filter	Composite from 5 body filters
Metallic iron	6.88	10.41	5.25
Iron oxide	8.37	6.25	16.50
Silica	65.60	57.56	62.33
Aluminum oxide	5.59	8.00	4.22
Calcium oxide	4.20	2.14	5.20
Magnesium oxide	2.29	2.40	1.80
Loss on ignition*	7.07	13.24	4.70
	100.00	100.00	100.00

* Principally carbon with possibly some water of combination of the mineral constituents.

Note: By spectrographic analysis, trace amounts of zinc, tin, lead, titanium, chromium, and copper were also found.

field test stage by the rigorous screening tests. These tests are discussed below only in terms of comparative results obtained on Calol filter coat.

Retention Test: The Farr Company's laboratory retention test is as follows: A weighed $\frac{1}{16}$-in. diameter metal rod is dipped in the test oil and drained in an oven at the specified temperature for 24 hrs. The amount of oil remaining on the rod is determined by weight difference, and an equivalent film thickness is calculated. Comparative results obtained from this test made on the new filter coat and the reference oil show that Calol filter coat retention at 200 deg. F is 7.1 times the retention of the reference oil at 200 deg. F.

Additional retention tests were made in California Research Corporation Laboratories on samples of the filter screen pack material to compare Calol filter coat with the reference oil. In one chart, the amount of filter adhesive lost from a filter screen section is shown as the temperature is increased to 185 deg. F. Each point represents the cumulative weight loss after two hours at the corresponding temperature. It will be noted that no loss occurs with Calol filter coat until the 160 deg. F transition temperature is exceeded. Another illustration shows the amount of adhesive that dripped from the screen packs after two hours at 185 deg. F. The effect of time at

operating temperatures of 90 deg. F and 120 deg. F on adhesive loss is shown in another chart. This is typical of mid-summer desert conditions, and it will be noted that conventional filter adhesive losses are high compared to no loss with Calol filter coat.

Flow Properties: The flow properties of Calol filter coat are a function of temperature relative to the reference oil. Below 160 deg. F, it is a soft, grease-like material that remains on the filter medium as a thick film in opposition to the removal forces of gravity and air flow encountered in air filter service. It will flow at temperatures below 160 deg. F when sufficient force is applied to exceed its yield point and, under these conditions, its resistance to flow (apparent viscosity) is a function of shear rate: the higher the shear rate, the lower the apparent viscosity. The material can be pumped at temperatures below 160 deg. F provided a positive suction pump is used to apply sufficient force to exceed its yield point.

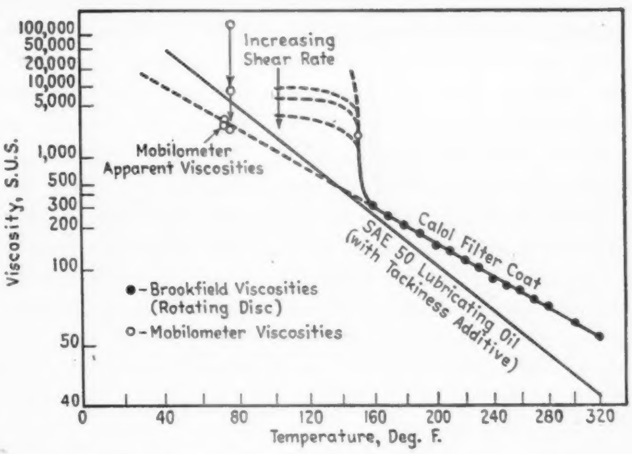
Above 160 deg. F, this adhesive is a viscous fluid and it behaves, flow-wise, like an oil with a viscosity index of 124. This property permits application of the adhesive to the filter by conventional methods employing a hot dip followed by centrifuging or hot cabinet storage to remove the excess material. In this respect the adhesive acts like grease, remaining in place when cool and easily applied when hot and fluid.

Wicking Test: The laboratory wicking test devised by the Farr Company is as follows: One end of a glass tube packed with a classified dust is immersed in the test oil, and the rate of oil rise in the dust column is determined as a function of time. Comparative results obtained from this test made on Calol filter coat and the reference oil show that the new filter coat wicks twice as fast as the reference oil at 75 deg. F.

Some qualitative wicking tests were performed to determine the effect of low temperatures on this property of Calol filter coat which retains its wet-surface wicking tendencies at a temperature as low as —20 deg. F. Neither an SAE 50 oil with a 0 deg. F pour point nor an S.A.E. 20 oil with a +20 deg. F pour point would wick at —20 deg. F, either in the Farr dust tube wicking test or on the filter paper surface. At +35 deg. F the relative wicking rates in the Farr dust tube were: SAE 50 oil, 1.00; Calol filter coat, 2.25; and SAE 20 oil 3.75.

Water Resistance Test: While there are no quantitative tests or specifications for this property of air filter adhesives, resistance to removal of the adhesive by accidental contact of the filter with water from car washing machines or heavy rains is generally recognized as a service requirement. In order to test this property, two pieces of freshly polished steel were dipped at 180 deg. F into Calol filter coat and the reference oil, drained, and immersed in warm (130 deg.-140 deg. F) water. The reference oil immediately started to "peel" from the steel surface, and rusting started within ten minutes indicating displacement of the oil film by water. The film of Calol filter coat on the other strip remained intact. The condition of the steel surfaces after ten days' immersion in water is illustrated. No displacement of the Calol filter coat occurred, whereas, the panel treated with the reference oil was completely covered with rust.

Wind Tunnel Test: The extremely accelerated wind tunnel test cycle developed for evaluating the effect of cycling air temperature on the filtering performance of the adhesive is as follows:



Flow properties of Calol filter coat in relation to reference oil.

(1) Air at 70 deg. F and 545 ft. per min. velocity containing the "slugging" concentration of 70 grams of dust per 1,000 cu. ft. of air is fed to the adhesive coated filter for ten min. and the filtering efficiency determined, or in other words the ratio of weight of dust retained on filter to weight of dust fed to the filter.

(2) Air at 200 deg. F and 545 ft. per min. is passed through the filter for ten minutes.

(3) Steps (1) and (2) are repeated successively to determine the rate of decrease of filtering efficiency versus the number of dust loading and heating cycles.

These tests also showed that Calol filter coat increased the dust holding capacity of a Farr air filter some 40 per cent under controlled laboratory comparisons with regular oils even under "slugging" dust concentrations. Efficiencies under these conditions were slightly lower than those under normal dust feed rates determined in the more precise large filter test set.

Application of the Adhesive: Application tests were carried out to determine the procedures necessary to obtain optimum amounts of the varied filter adhesives by dipping screen pack samples at various temperatures and draining or centrifuging for various times.

Results of application tests made on the small filters, and segments of screen pack, while not precise, were directionally useful in indicating field application limitations. Tests made on full-scale filters showed qualitatively that any desired amount of Calol filter coat could be applied to and retained on the filter by varying the dip temperature and the centrifuging time. The optimum amount of adhesive for a filter had never been determined by performance tests because only a relatively small amount (3-5 oz.) of any of the regular oils could be retained over a reasonable test period. It appeared that the optimum amount of filter adhesive would be the maximum amount that could be applied without "webbing over" or closing the screen holes. It was known that filling of the screen holes would reduce filtering efficiency by inducing air channeling.

Close-up examination of full-scale filters coated with increasing amounts of Calol filter coat indicated that 20 oz. of adhesive per filter (or 15 per cent of the weight of the screen pack) was a practical maximum application. With this amount of adhesive each wire had a relatively

thick uniform covering film and a reservoir of adhesive existed at each wire intersection, with all of the screen holes open. Above this amount, screen hole "webbing" was noted to begin and increase as the amount of adhesive was increased.

Field Test: An average of 10 oz. of Calol filter coat was applied to each of the 80 air filters (64 car body plus 16 engine intake) on a four-power-unit EMD Type F-7 Diesel freight locomotive operating in regular freight service on the Southern Pacific between Roseville, Cal., and Sparks, Nev. Each filter had previously been cleaned, tagged as to location on the locomotive, and weighed. All of the filters were weighed individually at approximately 800-mile intervals in order to obtain progressive dust loading data.

The test was started on October 15, 1951, and ended November 15, 1951. During this period all of the approximately 40 diesel freight locomotives maintained at Roseville were serviced with Calol filter coat on a routine regular filter maintenance basis. This procedure allowed general information to be obtained on handling the material, application performance, cleaning the dirty filters, and other practical field data to supplement the detailed progressive dust loading, pressure drop increase, and service retention data obtained on the test locomotives. Regular filter maintenance personnel were used without instruction or training in the use of Calol filter coat. The regular filter dipping tank temperature specification of 170-190 deg. F was continued in effect.

Results and Discussion

Results of the field test are summarized below:

Test Duration: Total mileage accumulated during this test without cleaning or recoating filters: 6,400 miles (regular filter change with reference oil every 2,500 miles).

Total Dust: Total weight of dust collected during 6,400 miles of operation: 64 car body filters—70 lb.

Average Filter Loading: Average dust load on car body filters; south side, 13.7 oz. per filter; North side, 21.5 oz. per filter; Overall, 17.5 oz. per filter.

Capacity Loading: Maximum dust load on any one car body filter—34 oz.

(A) This filter showed a pressure drop of 0.268 in. of water compared to 0.170 in. of water for a clean, oiled filter at the standard air filter test condition of 520 ft. per min. air velocity.

(B) Filtering efficiency for the 34 oz. dust load filter was 83.4 per cent of original clean oiled efficiency. The capacity load is considerad to be reached when efficiency drops to 85 per cent of original. Regular oiled filter with 3⅛ oz. of oil drops below this figure at an 11 oz. dust load.

Reduced Maintenance: Even before the end of the test period, the filter change period on all locomotives was extended by the Southern Pacific from the regular 2,500 miles of operation to 5,000 miles for routine service. This move was obvious when the markedly improved, still oil-wet condition of the filters was noticed at the regular 2,500-mile service periods on all locomotives after they had operated with Calol filter coat-treated filters.

Adhesive Retention in Service: The troublesome oil drippage from all filters was eliminated, and drip pans required on the hot running engine air intake filters when using regular oil-treated filters were removed as unnecessary. (These drip pans are a regular part supplied by the engine manufacturer.)

Dust Loading Versus Locomotive Operation: Most of the dust loading occurs in this type of service on the slow uphill pull rather than on the down grade run. The locomotives shuttles east and west with unit No. 6307 at the head end when the train is traveling east on ahe relatively long uphill pull from Roseville at 200 ft. above sea level to the Sierra Nevada crest at 7,000 ft. elevation, thence, to Sparks at 4,400 ft. elevation. Returning west, this unit is trailing and unit No. 6306 is at the head end of the train. These locomotives reverse direction of travel at each end of their run and do not customarily turn around.

Source of Dust: Sanding the rails (continuous on upgrade haul) is evidently the source of the dust which accumulates faster in filters on units that are always trailing on the long uphill pull than on the leading units. It was noted by visual observation of the locomotive in operation that dust generated by sanding the rails was blown out from under the locomotive by the armature cooling blowers and billowed up around the locomotive reaching the air filter level toward the rear of the lead power unit and enveloping the three trailing units. Chemical analysis of the dust removed from several filters showed the predominating constituents to be silica, metallic iron, and iron oxide with an appreciable amount (by volume) of carbon presumably from engine exhaust gas recycling in the tunnels. The maximum engine air intake occurs at full power output on the slow upgrade travel with essentially continuous rail sanding generating the maximum amount of dust.

Rate of Dust Accumulation: Progressive dust loading curves are shown for the maximum, minimum, and overall average dust-loaded filters. It will be noted that all three of these curves show an essentially constant rate of dust loading up to the final 1,000 miles of the test. The decrease in rate of dust loading during the last 1,000 miles of the test appears to be due to the heavy rain which occurred in this period rather than capacity loading of the filters, since the minimum load and the overall agerage load curves both show the same end flattening as the maximum load curve. The 34 oz. loaded filter (maximum obtained on this test) was judged on the basis of wind tunnel test results to be loaded to the capacity of the amount of filter adhesive originally applied (12 oz.). These tests proved conclusively that had more adhesive been applied, the useful life of the filter could have been extended. Assuming a maximum nonscreen-hole-webbing application of 20 oz. of Calol filter coat, it appears that close to 9,000 miles of operation could be obtained in this service before reaching the 55 to 60 oz. maximum dust load capacity estimated on the basis of the above figures. These estimates are supported further by laboratory wind tunnel tests wherein it was shown that the same type of filter with 20 oz. of Calol filter coat accumulated 56.1 oz. of standard test dust with an average efficiency 97.3 per cent of maximum theoretical and final pressure drop of 1.010 in. of water. It was shown previously that a similar filter with 3⅛ oz. of the reference oil failed on efficiency (below 85 per cent of maximum theoretical) at a dust load of only 11 oz. when subjected to both naturally occuring atmospheric dust and standard test dust.

Engine Filter Versus Car Body Filter: Adhesive retention and dust loading in service, respectively, are illustrated in two views of a typical engine intake air filter and a car body filter with 34 oz. dust load. These pictures were taken with a strong light behind the filter and a brief frontal exposure to show the frontal appearance. It will be noted that the engine intake filter is still in an original fresh oiled condition after 30 days and 6,400 miles of service as shown by the light penetration of the filter and its shiny oil-wet wire surfaces. This condition indicates sustained rentention of Calol filter coat on the filter and low filtering duty since, except for miscellaneous body air leakage, all of the air entering the engine intake passes first through the car body filters. The dust loaded car body filter allows penetration of only a few specks of light, and each individual wire is coated with a heavy layer of dust particles. Their pressure drop, however, had only increased 0.098 in. of water.

The stainless strip ready for welding is held in shop-made positioning jig.

Operator using Heliarc welding to make straight butt-weld in thin stainless steel.

The completed Heliarc weld is difficult to detect in the repaired stainless-steel strip.

Welding Light-Gage Stainless Steel

Making straight-butt welds in 18-8 stainless steel, .019 in thick, is routine practice in the repair shops of Pullman Company in Chicago. This work is being done by using Heliarc welding on stainless steel fluted side members of passenger cars which are frequently damaged in service.

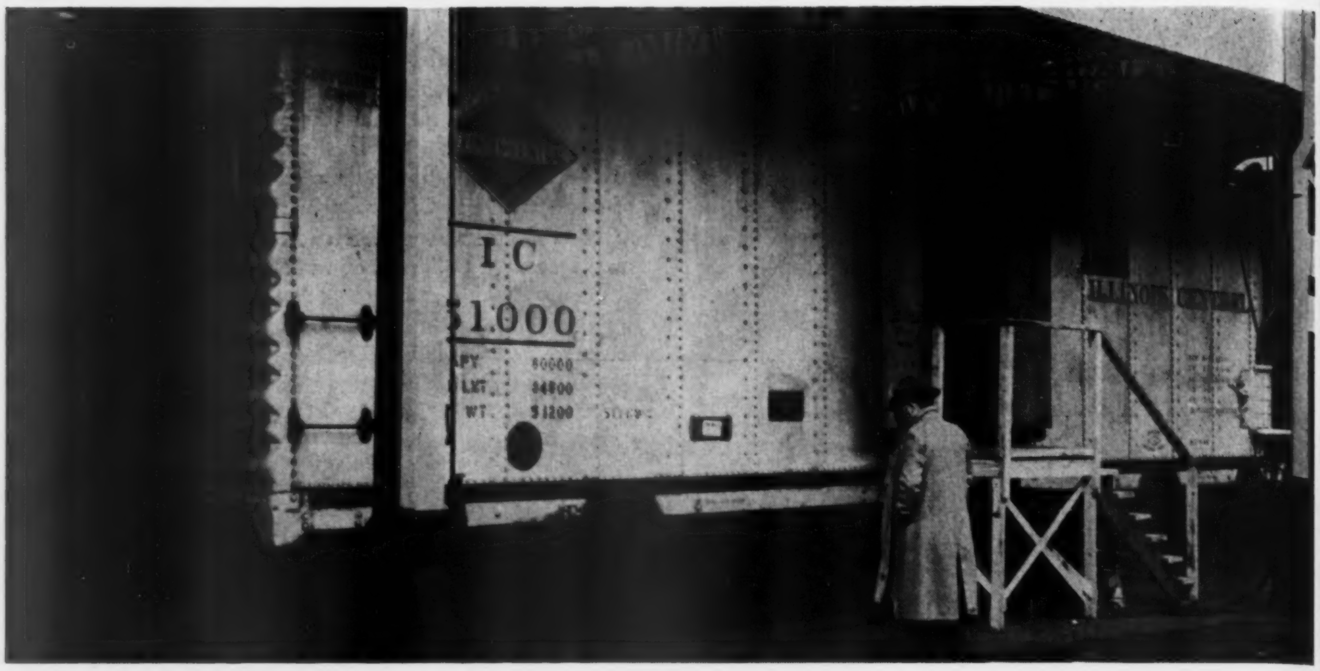
The damaged stainless strips are first loosened from the car side in order to weld in a new section. Damaged ends are cut off square and a new section is tightly butted and held in place by a hinged copper back-up and hold-down fixture that conforms to the shape of the fluting. Simple screw clamps force the fluted strip against the back-up.

This is shown in one of the illustrations and another indicates how the weld is made with a Heliarc torch and .040 in. diameter tungsten electrode. The current is 11 amp. and the argon shielding gas flows at the rate of 15 cu. ft. per hour. Added rod is Oxweld No. 28, 1/16 in. diameter.

A finished joint, as welded, is shown. Heliarc welding makes possible minimum build-up with no spatter. A quick, light grinding followed by buffing produces a finished joint in which it is difficult to detect the presence of a weld.

The Pullman Company effects important economies by being able to make this type of weld. Prior to the successful welding of such thin fluted material, it was necessary to replace a strip for the entire length of the car side. This in itself was wasteful and to ship these 70 ft. lengths required two flat cars. The company now receives from the supplier short lengths which can be shipped on one car and are joined as required to the undamaged sections left on cars needing repairs.

A wheeled cart holds a.c. electric supply, cooling water for torch, and a cylinder of argon.



I. C. aluminum refrigerator car ready for inspection.

Six Years' Experience with An Aluminum Reefer...

Inspection of Illinois Central car discloses no structural deterioration. Bunkers, defects in which were corrected three years ago, show no further deterioration.

THE Illinois Central built an experimental aluminum refrigerator car at the company shops, McComb, Miss., as described in *Railway Mechanical and Electrical Engineer,* page 645 of the December, 1946 issue, this car featuring convertible bunkheads, stage icing, forced air circulation, Duryea underframe and A-3 trucks. On October 7, this car No. 51,000 was returned to McComb shops and stripped to the extent necessary for detailed inspection by a group of interested observers representing railroads, private car companies and supply companies.

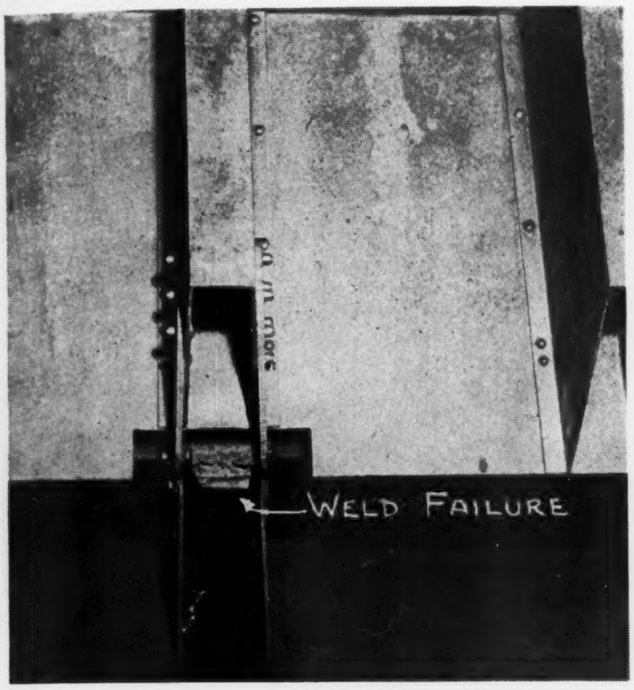
The purpose of the inspection was to determine the condition of the car after six years of service, and to make a comparison with findings of a previous inspection made in June, 1949. In general, the car was found to be in excellent condition. The service rendered, was comparable to that of any steel refrigerator, but the condition of the car showed only minor mechanical defects, which would be found in any type of car used in the same service for the same period of time. No evidences of any deterioration of the aluminum superstructure of the car, or of the steel parts used in the underframe were apparent.

The upper portion of the inner stile of the end ladder on the A-end of the car was bent in towards the car. There was still two inches clearance at the treads, but the treads were not parallel with the end of the car. All other safety appliances, subject to the United States Safety Appliance Act, were found to be in satisfactory condition, including the aluminum brake step and running board.

The body brakes were in good condition. There was no noticeable wear in the foundation rigging. All the piping was in good condition, and all pipe clamps were tight. Emergency and service portions of the AB-valve had been replaced, but this could be attributed to normal wear and necessary cleaning of air brakes under interchange rules.

Floor and Floor Racks

There was a marked deformation of the watertight floor membrane over the 14-gage aluminum flashing on the AR side of the car. This flashing extends in one piece

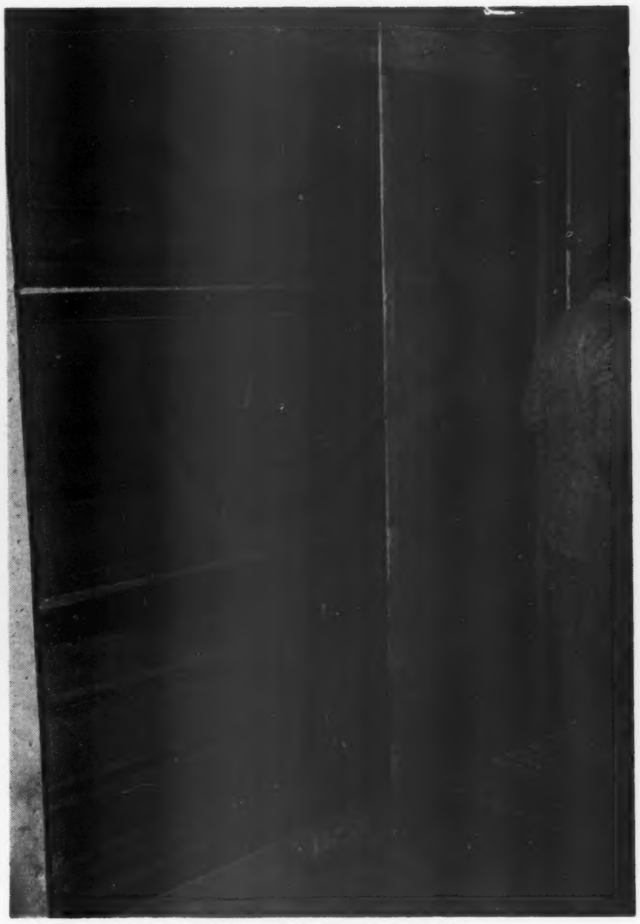


Weld failure in floor rack hinge first applied.

4 in. up the bottom side belt rail and out on the main floor boards for a distance of 12 in. The floor boards are grooved to allow the top of the flashing to be flush with the top of the floor boards. This permits the watertight membrane to lie flat from side to side of the car. The condition now existing at the "AR" side indicates that the flashing leg on the main floor has raised up over the top of the floor boards, causing a ridge in the membrane. It was not deemed advisable to make a further inspection of this condition at this time. The membrane was not broken, and the possibilities are limited of obtaining a good condition upon replacing the membrane after an inspection.

The Ureco all-aluminum floor racks were in excellent condition. The only defects found were similar to those found at the inspection of June 8, 1949. The fabricated hinges used on the floor rack section between the fan housing and bulkhead had failed at the welds. However, it should be mentioned that these hinges were hand-made due to only one car set being required; In regular quantity production the hinges would be cast. Also a number of Huck lock bolts, used to assemble the slats to the stringers, were found to have split collars.

The plywood sheathing used in the flue lining and ceiling was in good condition. The grey enamel paint used on the inside finish was in fair condition on the side walls, but was badly blistered on the ceiling. The blistering, greatest at the doorway area, was evidently caused by condensation. The grey enamel paint now on the inside finish is the second finish coat that has been applied to this car since it was built. It is possible that some of this blistering was caused by a poor binding between the second and first coats. The second coat was applied three years after the first coat. It was not necessary from a protective standpoint to apply the second coat; but the car was to be exhibited at the Chicago Railroad Fair in 1949 and the paint was applied from an appearance standpoint.



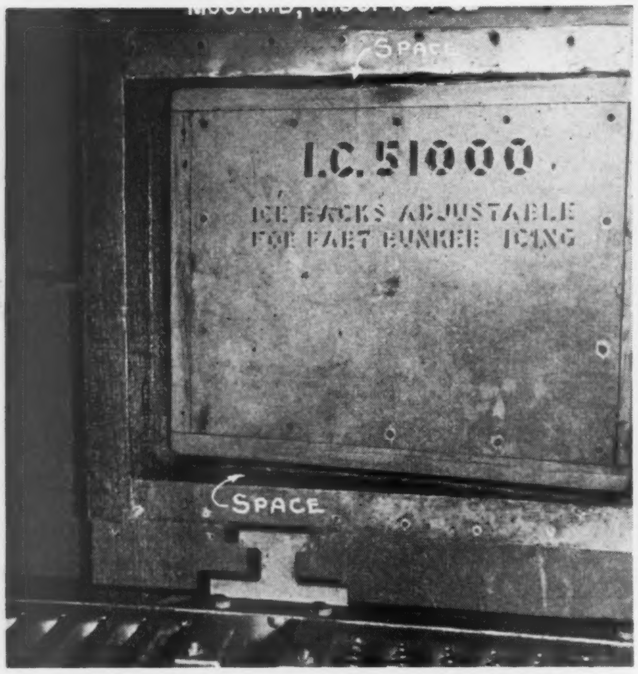
Section of inside lining removed to show condition of insulation.

Ice Bunkers

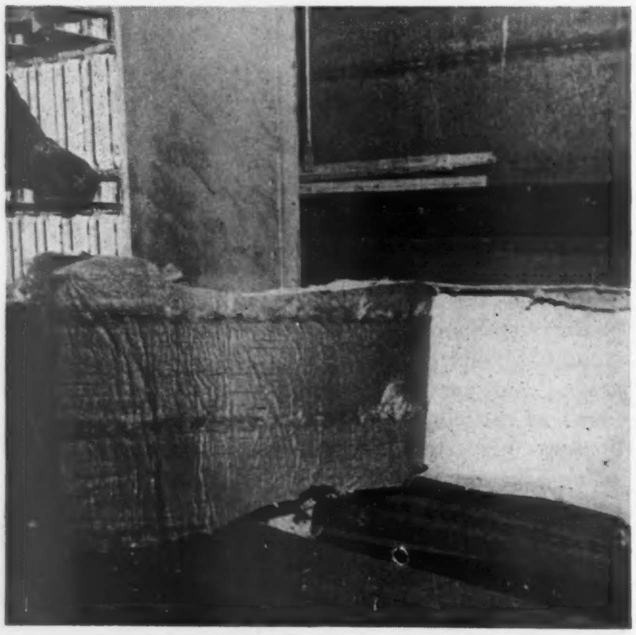
Most of the defects found in the inspection made at Burnside Shops in 1949 were in the mechanical and structural features of the Equipco ice bunker, locks, grates, and operating mechanism. All of the defects found at that time were corrected, and particular attention was given to these parts at this inspection, all of which were found to be in perfect condition. The only defect found was a deformation of one full-stage ice grate. This grate was in position, was serviceable, and could only be classified as defective when necessary to "nest" it in order to convert the bulkhead. Since the convertible bulkhead feature is not used and, incidentally, is no longer felt to be essential, this defective grate in no way detracted from the serviceability of the car.

Insulation

The side-wall linings were removed from the "AL" end of the car at the same location as inspected on June 8, 1949, and the Fiberglas insulation was found to be in excellent condition. The discoloration of paper covering around the stitching, which had been noted at the inspection in Burnside Shops, had not progressed to any great degree. The insulation was dry and had the same fullness as when installed. Since the point of inspection of the side-wall insulation was at the same point where the insulation had been cut for the installation of the Preco fan, it was decided to cut into the insulation for a distance of several feet from the Preco fan location. This was done to determine if the amount



Hatch combing forced slightly away from framing probably by heavy blows in loading ice.



Fiberglas insulation after six years.

of dust present at the fan point extended to any great degree into the insulation, and also to determine if the insulation farther back along the car wall was in the same dry, fluffy condition. This insulation was found to be in excellent condition and had all the qualities and characteristics of new insulation.

The ceiling panel directly over this section was also opened for comparison with earlier inspection, and was found to be in excellent condition. No attempt was made to open the floor to inspect the floor insulation since its general condition indicated such disturbance of the floor to be unwarranted.

Roof and Hatches

The changes in design made to the vent iron and

Roof hatch and vent iron in which early defects were corrected.

hatch plug after the inspection of 1949 have proved to be corrective, since the defects found at the earlier inspection were not noticeable at this time. The roof sheets have not been washed or given any protection beyond that given to any house-type car; and although a thin layer of dirt was present, the aluminum sheets of the roof showed no signs of corrosion or pitting. This was noted after having cleaned off a panel of the roof to determine the condition of the metal.

The hatch coaming which extends down in the hatch openings and which was originally formed to bear against the hatch framing has moved away from the framing. This could be caused by heavy blows, caused by ice cakes, hitting the top portion of the coaming and deforming the original shape of the coaming.

When this car was originally built, it was equipped with ceiling fixtures which worked on stand-by connections. These ceiling fixtures at the time of this inspection were found to be without frames, lens, or bulbs. It is evident that this defect was caused more by vandalism than mechanical failure.

Trucks

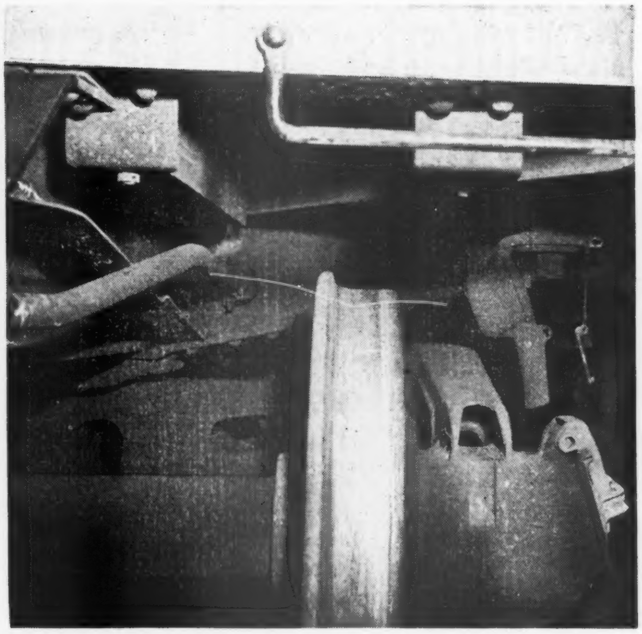
This car is equipped with The American Steel Foundries' A-3 Ride-Control trucks. There were no indications of appreciable wear on any of the ride control features, nor were there indications of any parts having been replaced. The trucks are still equipped with the A.A.R. alternate standard tubular axles and the 1W-WS wheels with which they were originally equipped in 1946. The 1W-WS wheels showed only normal wear.

Uncoupling Mechanism

A point of wear was noted on the uncoupling rod at the point of contact with the uncoupling rod bracket. This is a defect quite common in all types of cars equipped with this particular design of uncoupling mechanism.

There were no indications of failure of any part of the Preco fan. The only thing noticed was that the

Cleaned aluminum roof sheet shows no corrosion.



One-wear steel wheels in A-3 truck showed only normal wear after six years.

name plates on the fan guard housings were deformed in a blistered or bulged manner. Since these name plates in no way enter into the operation of the fan, and are held on to the fan housing by six small rivets, no reason could be given for this deformity except for the difference in materials used where expansion or contraction was not equal and the name plates were deformed.

Duryea Cushion Underframe

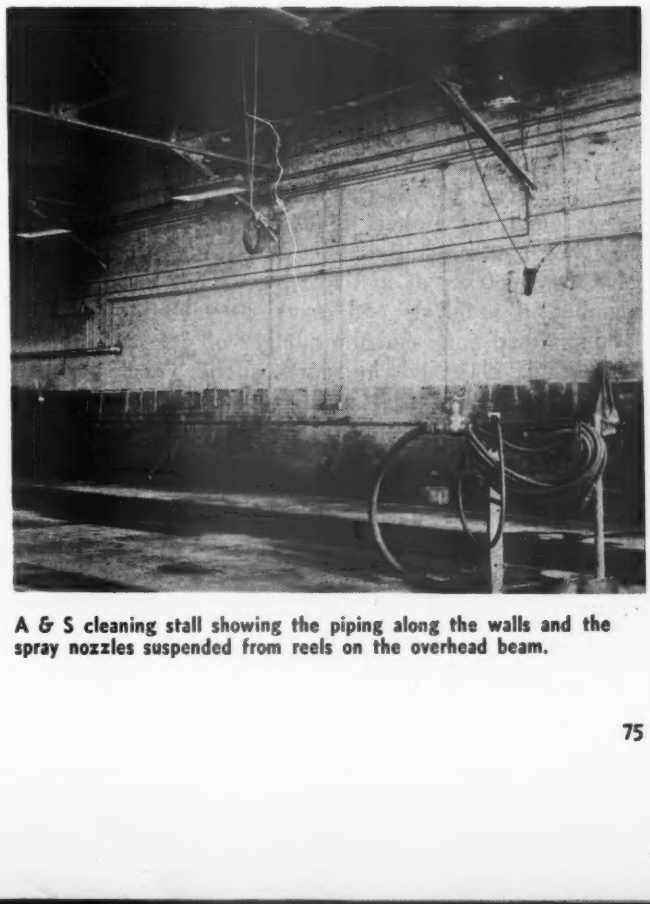
The Duryea Underframe of this car is the only major steel unit used in the car structure and the parts which were found defective at the first inspection, and which were repaired at that time, were found to be in excellent condition. This underframe had been given a coat of car cement when built, and this covering was found to be scaling and to be worn thin due to abrasion. The only aluminum parts used in the underframe are the four crossbearer ties, which are experimental alloys of the Aluminum Company of America and were found in perfect condition.

Diesel Locomotive Cleaning Arrangement

The Alton and Southern has equipped one stall on its diesel enginehouse at East St. Louis, Ill., with a pressure spray system for keeping its diesel locomotives clean.

The system comprises three drums containing commercial cleaning solution under 35-lb. pressure, piping along the wall extending most of the length of the stall, and a pair of spray nozzles on hose reels suspended from an overhead beam to serve either side of the locomotive. The nozzles normally hang high enough and with sufficient clearance on the side of the locomotive to avoid interfering with movement in and out. They are reached from the running board of the road switchers, which comprise all A & S motive power.

The pressurized liquid system was installed rather than a siphon spray because it spreads the fumes around much less than the siphon spray where air is the carrier of the solution.



A & S cleaning stall showing the piping along the walls and the spray nozzles suspended from reels on the overhead beam.

Accidents and Casualties Caused by Locomotive Failures Continue To Decline

Bureau of Locomotive Inspection report shows crown-sheet failures declining. Injectors, footboards and handholds on steam, short circuits and fires on others, greatest sources of accidents.

A REDUCTION in the number of accidents caused by failure of some part or appurtenance of the steam locomotive from 167 to 122 for the fiscal year ended June 30, 1952, was shown by Edward H. Davidson, director of the Bureau of Locomotive Inspection in his annual report to the Interstate Commerce Commission. During the same period the number of accidents caused by failure of some part or appurtenance of locomotive units other than steam increased from 54 to 74, making the total number of accidents for all types of locomotives 196 as compared with 221 for the preceding year.

The decline in casualties was proportionately greater than that in accidents. For all classes of motive power the number of persons killed declined from 16 to 4 and the number of injured from 299 to 203. Declines in both classes of casualties were reported for all types of locomotives. The number killed in steam locomotive accidents declined from 14 to 3 and in accidents involving locomotives other than steam, from 2 to 1. The number of persons injured in steam locomotives declined from 170 to 126 and on locomotives other than steam, from 129 to 77.

The report reflects the progress being made in dieselization. The number of steam locomotives for which reports were filed dropped from 26,599 during the 1951 fiscal year to 20,490 during the 1952 fiscal year. In the same period units other than steam for which reports were filed increased from 19,320 to 22,716. The total for all classes of power declined from 45,915 to 43,206.

The tables show the trend in the number of locomotives, number inspected, the number on which defects were found, the number of defects, and the number of accidents and casualties each year 1947 to 1952 inclusive, for all types of motive power. They also show the number of accidents and casualties caused by failures of individual parts and the number of defects found on inspection, classified by parts. Boiler explosions no longer cause the largest number of casualties. Injectors and connections with nine casualties, one of which was a fatality; footboards with nine; handholds with eight, and reversing gears with seven compare with six casualties from boiler explosions, one of which was a fatality. Short circuits, with eleven casualties and fires with eight, are the outstanding groups on locomotives other than steam.

Of the 24,738 defects in 63 parts of steam locomotives

TABLE I.—REPORTS AND INSPECTIONS

STEAM LOCOMOTIVES

	Year ended June 30—					
	1952	1951	1950	1949	1948	1947
Number of locomotives for which reports were filed	20,490	26,595	29,743	33,866	37,073	39,578
Number inspected	45,220	62,113	66,809	85,353	93,917	94,034
Number found defective	6,234	7,995	6,740	7,035	9,417	10,248
Percentage of inspected found defective	13.8	12.9	10.1	8.2	10.0	10.9
Number ordered out of service	370	508	399	436	654	708
Number of defects found	24,738	34,657	28,504	28,642	38,855	41,250

LOCOMOTIVE UNITS OTHER THAN STEAM

	Year ended June 30—					
	1952	1951	1950	1949	1948	1947
Number of locomotive units for which reports were filed	22,716	19,320	15,719	12,692	9,803	7,805
Number inspected	65,263	52,948	42,503	30,684	20,798	13,115
Number found defective	6,087	4,375	2,748	1,238	853	633
Percentage of inspected found defective	9.3	8.3	6.5	4.0	4.1	4.8
Number ordered out of service	135	106	42	20	21	19
Number of defects found	16,613	11,935	6,325	2,804	1,745	1,442

TABLE II.—ACCIDENTS AND CASUALTIES CAUSED BY LOCOMOTIVE PARTS FAILURES

STEAM LOCOMOTIVE, INCLUDING BOILER, OR TENDER

	Year ended June 30—					
	1952	1951	1950	1949	1948	1947
Number of accidents	122	167	169	228	341	360
Percent increase or decrease from previous year	26.9	1.2	25.9	33.1	6.3	14.1
Number of persons killed	3	14	7	10	15	16
Percent increase or decrease from previous year	78.6	100[1]	30.0	33.3	6.3	60.0[1]
Number of persons injured	126	170	184	342	361	461
Percent increase or decrease from previous year	25.9	7.6	24.3	32.7	22.2	5.7[1]

STEAM LOCOMOTIVE BOILER [1]

	Year ended June 30—							
	1952	1951	1950	1949	1948	1947	1915	1912
Number of accidents	35	51	59	81	104	116	424	856
Number of persons killed	2	3	4	9	14	12	13	91
Number of persons injured	36	59	70	94	108	124	467	1,005

LOCOMOTIVE UNITS OTHER THAN STEAM

	Year ended June 30—					
	1952	1951	1950	1949	1948	1947
Number of accidents	74	54	51	49	41	40
Number of persons killed	1	2	3	....	....	2
Number of persons injured	77	129	50	67	50	41

[1] Increase.
[2] The original act applied only to the locomotive boiler.

TABLE III—ACCIDENTS AND CASUALTIES RESULTING FROM FAILURES OF LOCOMOTIVE PARTS

STEAM LOCOMOTIVES AND TENDERS AND THEIR APPURTENANCES

Part or appurtenance which caused accident	Year ended June 30— 1952			1951			1950			1949		
	Accidents	Killed	Injured	Accidents	Killed	Injured	Accidents	Killed	Injured	Accidents	Killed	Injured
Air reservoirs	1	..	1	...	..	...	...	..	...	...	..	...
Aprons	...	..	...	1	..	1	2	..	2	3	..	3
Arch tubes	...	..	...	1	..	1	1	..	1	...	..	...
Ashpan blowers	...	..	...	...	..	...	...	..	...	1	..	1
Axles	1	..	1	...	..	...	...	..	...	...	..	...
Blow-off cocks	2	..	2	2	..	2	2	..	2	5	1	4
Boiler checks	3	..	3	3	..	3	3	..	3	4	..	5
Boiler explosions:												
A. Shell explosions	...	..	...	...	..	...	...	..	...	...	..	...
B. Crown sheet; low water; no contributory causes found	3	1	5	5	3	8	8	4	12	4	6	13
C. Crown sheet; low water; contributory causes or defects found	1	..	1	1	..	5	1	..	2	1	1	1
D. Miscellaneous fire box failures	...	..	...	...	..	...	...	..	...	...	..	...
Brakes and brake rigging	2	..	2	3	3	3	2	..	2	3	..	4
Couplers	...	..	...	2	..	2	4	1	4	3	..	4
Crank pins, collars, etc.	...	..	...	2	1	1	1	..	1	...	..	...
Crossheads and guides	1	..	1	1	..	1	1	1	2	1	..	1
Cylinder cocks and rigging	...	..	...	...	..	...	...	..	...	...	..	...
Cylinder heads and steam chests	...	..	...	...	..	...	...	..	...	...	..	...
Dome caps	...	..	...	...	..	...	...	..	...	...	..	...
Draft appliances	...	..	...	...	..	...	...	..	...	3	..	3
Draw gear	...	..	...	1	..	1	1	..	1	...	..	...
Fire doors, levers, etc.	3	..	4	2	..	2	2	..	2	3	..	3
Flues	1	..	1	3	..	3	6	..	9	3	..	3
Flue pockets	...	..	...	...	..	...	...	..	...	...	..	...
Footboards	9	..	9	8	..	8	8	..	8	10	..	10
Gage cocks	...	..	...	...	..	...	...	..	...	1	..	1
Grease cups	...	..	...	...	..	...	1	..	1	...	..	...
Grate shakers	3	..	3	7	..	7	6	..	6	11	..	11
Handholds	8	..	8	14	..	14	11	..	11	13	1	12
Headlights and brackets	1	..	1	1	1	...	1	..	1	1	..	1
Injectors and connections (not including injector steam pipes)	9	1	8	3	..	3	7	..	7	12	..	12
Injector steam pipes	...	..	...	1	..	1	...	..	...	...	..	...
Lubricators and connections	1	..	1	4	..	4	2	..	2	4	..	4
Lubricator glasses	...	..	...	...	..	...	1	..	1	1	..	1
Patch bolts	...	..	...	...	..	...	...	..	...	...	..	...
Pistons and piston rods	...	..	...	...	..	...	...	..	...	...	..	...
Plugs, arch tube and washout	...	..	...	2	..	2	1	..	1	...	..	...
Plugs in firebox sheets	...	..	...	...	..	...	...	..	...	...	..	...
Reversing gear	5	..	7	5	..	5	9	1	8	6	..	6
Rivets	...	..	...	...	..	...	...	..	...	1	..	1
Rods, main and side	3	1	3	...	..	...	1	..	2	2	..	2
Safety valves	...	..	...	...	..	...	...	..	...	...	..	...
Sanders	3	..	3	1	..	1	4	..	4	4	..	4
Side bearings	...	..	...	...	..	...	...	..	...	1	..	1
Springs and spring rigging	1	..	1	2	..	2	3	..	3	1	..	1
Squirt hose	4	..	4	6	..	6	9	..	9	14	..	14
Stay bolts	...	..	...	2	..	2	1	..	1	...	..	...
Steam piping and blowers	1	..	1	3	..	3	3	..	6	4	1	3
Steam valves	2	..	2	3	..	3	3	..	3	3	..	3
Studs	...	..	...	...	..	...	1	..	1	1	..	1
Superheater tubes	...	..	...	1	..	1	3	..	3	3	..	6
Throttle glands	1	..	1	...	..	...	2	..	2	3	..	4
Throttle leaking	...	..	...	5	..	5	2	..	2	1	..	...
Throttle rigging	5	..	5	5	..	5	7	..	7	11	..	11
Trucks, leading, trailing, or tender	1	..	1	2	..	2	...	..	...	3	..	3
Valve gear, eccentrics, and rods	...	..	...	2	..	2	...	..	...	1	..	1
Water glasses	2	..	2	1	..	1	3	..	3	5	..	5
Water-glass fittings	...	..	...	...	..	...	...	..	...	3	..	4
Wheels	...	..	...	1	..	1	...	..	...	...	..	...
Miscellaneous	45	..	45	61	6	59	46	..	49	74	..	75
Total	122	3	126	167	14	170	169	7	184	228	10	243

LOCOMOTIVE UNITS OTHER THAN STEAM, AND THEIR APPURTENANCES

Part or appurtenance which caused accident	1952 Accidents	Killed	Injured	1951 Accidents	Killed	Injured	1950 Accidents	Killed	Injured	1949 Accidents	Killed	Injured
Brakes and brake rigging	5	..	6	2	..	3	4	..	4	4	..	5
Carburetors	...	..	...	...	..	...	...	..	...	...	..	...
Couplers	2	..	2	1	..	1	1	..	1	1	..	1
Crank pins and connecting rods	...	..	...	...	..	...	...	..	...	...	..	...
Fires due to overflowing or leakage of fuel, crankcase explosions, back firing, etc.	7	..	8	9	..	10	4	..	4	8	..	9
Generators and starting devices	...	..	...	2	..	2	1	..	1	1	..	1
Insulation	...	..	...	1	..	1	...	..	...	1	..	1
Pantographs and trolleys	...	..	...	1	1	...	1	1	...	1	..	6
Short circuits	9	..	11	9	..	9	2	..	2	6	..	1
Miscellaneous	51	1	50	29	1	103	38	2	38	27	..	43
Total	74	1	77	54	2	129	51	3	50	49	..	67

TABLE IV—NUMBER OF STEAM LOCOMOTIVES REPORTED, INSPECTED, FOUND DEFECTIVE, AND ORDERED OUT OF SERVICE

	Parts defective, inoperative or missing, or in violation of the rules	Year ended June 30— 1952	1951	1950	1949	1948
1	Air compressors	671	897	719	693	1,007
2	Arch tubes	12	17	9	11	15
3	Ashpans and mechanism	59	64	59	52	72
4	Axles	1	4	1	4	8
5	Blow-off cocks	299	262	220	220	274
6	Boiler checks	356	477	386	337	424
7	Boiler shell	174	226	211	208	298
8	Brake equipment	1,955	2,453	1,845	1,806	2,617
9	Cabs, cab windows, and curtains	694	1,173	862	781	1,049
10	Cab aprons and decks	295	395	364	355	414
11	Cab cards	53	83	97	95	109
12	Coupling and uncoupling devices	42	54	41	42	55
13	Crossheads, guides, pistons, and piston rods	1,035	1,363	1,100	1,147	1,611
14	Crown bolts	38	52	53	46	78
15	Cylinders, saddles, and steam chests	908	1,437	1,160	1,155	1,617
16	Cylinder cocks and rigging	328	474	376	356	494
17	Domes and dome caps	85	131	90	82	142
18	Draft gear	313	441	368	370	461
19	Draw gear	189	297	280	300	413
20	Driving boxes, shoes, wedges, pedestals, and braces	681	1,145	1,037	1,070	1,582
21	Firebox sheets	141	203	181	191	302
22	Flues	121	184	152	156	201
23	Frames, tail pieces, and braces, locomotive	368	486	451	451	576
24	Frames, tender	26	47	34	39	72
25	Gages and gage fittings, air	136	173	116	118	185
26	Gages and gage fittings, steam	228	325	272	268	354
27	Gage cocks	337	495	386	375	474
28	Grate shakers and fire doors	282	339	326	286	455
29	Handholds	353	420	439	421	513
30	Injectors, inoperative	34	60	45	39	66
31	Injectors and connections	1,615	2,190	1,767	1,795	2,329
32	Inspections and tests not made as required	68	121	122	104	148
33	Lateral motion	274	465	389	507	821
34	Lights, cab and classification	44	118	60	58	132
35	Lights, headlight	100	108	131	118	183
36	Lubricators and shields	160	222	157	157	236
37	Mud rings	149	153	145	147	186
38	Packing nuts	552	638	558	474	456
39	Packing, piston rod and valve stem	494	765	510	511	658
40	Pilots and pilot beams	102	124	126	73	132
41	Plugs and studs	91	117	104	99	169
42	Reversing gear	429	631	404	405	649
43	Rods, main and side, crank-pins, and collars	990	1,511	1,213	1,408	1,998
44	Safety valves	39	45	34	45	45
45	Sanders	552	806	641	608	597
46	Springs and spring rigging	2,424	3,340	2,848	3,177	4,124
47	Squirt hose	69	90	74	63	93
48	Stay bolts	254	280	229	227	292
49	Stay bolts, broken	159	282	193	196	258
50	Steam pipes	232	342	302	256	435
51	Setam valves	146	181	131	133	150
52	Steps	561	805	680	652	767
53	Tanks and tank valves	980	1,304	1,205	1,228	1,757
54	Telltale holes	15	33	28	33	60
55	Throttle and throttle rigging	608	927	664	709	923
56	Trucks, engine and trailing	427	700	580	545	812
57	Trucks, tender	474	710	540	471	652
58	Valve motion	437	673	486	484	676
59	Washout plugs	266	325	289	268	384
60	Stokers	253	306	261	216	270
61	Water glasses, fittings, and shields	651	858	907	920	1,039
62	Wheels	340	536	394	455	779
63	Miscellaneous—signal appliances, badge plates, brakes (hand)	569	774	652	626	707
	Number of defects	24,738	34,657	28,504	28,642	38,855
	Locomotives reported	20,490	26,595	29,743	33,866	370,73
	Locomotives inspected	45,220	62,113	66,809	85,353	93,917
	Locomotives defective	6,234	7,995	6,740	7,035	9,417
	Percentage of inspected found defective	13.8	12.9	10.1	8.2	10.0
	Locomotives ordered out of service	370	508	399	436	654

TABLE V—NUMBER OF LOCOMOTIVE UNITS OTHER THAN STEAM REPORTED, INSPECTED, FOUND DEFECTIVE, AND ORDERED FROM SERVICE

	Parts defective, inoperative or missing, or in violation of the rules	Year ended June 30—				
		1952	1951	1950	1949	1948
1	Air compressors	206	146	99	26	32
2	Axles truck and driving	3	2	2	1	3
4	Batteries	39	85	20	13	8
5	Boilers	69	43	46	9	30
6	Brake equipment	1,450	1,166	673	299	204
8	Cabs and cab windows	813	672	377	159	90
9	Cab cards	139	100	75	46	37
10	Cab floors, aprons, and deck plates	1,694	1,281	726	234	134
11	Clutches	5	4	1	2	......
12	Controllers, relays, circuit breakers, magnet valves, and switch groups	222	166	61	35	24
13	Coupling and uncoupling devices	76	35	32	15	12
14	Current collecting apparatus	5	9	18	20	11
16	Draft gear	202	141	91	66	36
17	Draw gear	28	46	27	13	8
18	Driving boxes, shoes, and wedges	98	38	51	33	16
20	Frames or frame braces	33	27	9	5	2
22	Fuel system	1,751	1,082	483	191	136
23	Gages or fittings, air	110	70	29	11	11
24	Gages or fittings, steam	11	14	14	2	2
25	Gears and pinions	26	9	15	6	9
26	Handholds	127	97	70	53	32
28	Inspections and tests not made as required	159	143	116	90	59
29	Insulation and safety devices	102	64	48	36	10
30	Internal-combustion engine defects, parts and appurtenances	4,768	3,270	1,456	602	214
32	Jack shafts	1	5	8	11	5
33	Jumpers and cable connectors	191	190	86	8	7
35	Lateral motion, wheels	8	11	2	7	18
36	Lights, cab and classification	49	23	7	5	5
37	Lights, headlight	22	16	9	3	3
39	Meters, volt and ampere	41	14	7	......	3
40	Motors and generators	674	314	106	46	26
42	Pilots and pilot beams	53	36	29	16	23
43	Plugs and studs	3	3	......	......	......
44	Quills	15	26	10	9	16
46	Rods, main, side, and drive shafts	15	2	6	1	5
48	Sanders	1,202	902	356	151	106
49	Springs and spring rigging, driving and truck	153	108	103	43	44
51	Stay bolts, broken or defective	1	......	1	......	......
53	Steam pipes	89	24	32	17	10
54	Steps, footboards, et cetera	480	377	284	213	116
55	Switches, hand-operated, and fuses	18	15	9	1	3
56	Transformers, resistors, and rheostats	2	9	9	2	6
57	Trucks	390	234	182	84	65
59	Water tanks	47	33	20	2	1
60	Water glasses, fittings, and shields	38	11	27	2	18
61	Warning signal appliances	117	83	21	9	7
62	Wheels	230	215	95	98	72
63	Miscellaneous	638	574	377	109	39
	Number of defects	16,613	11,935	6,325	2,804	1,745
	Locomotive units reported	22,716	19,320	15,719	12,692	9,803
	Locomotive units inspected	65,263	52,948	42,503	30,684	20,798
	Locomotive units defective	6,087	4,375	2,748	1,238	853
	Percentage of inspected found defective	9.3	8.3	6.5	4.0	4.1
	Locomotive units ordered out of service	135	106	42	20	21

found on inspection, 12 parts are responsible for about one-half of the defects. Of the 16,613 defects found in 63 parts of locomotives other than steam, eight parts are responsible for more than three-quarters of the defects.

Copies of published reports of accident investigations were distributed to interested parties and otherwise used by the bureau to bring about a diminution in the number of such accidents.

During the year 14 per cent of the steam locomotives and 9.3 per cent of locomotive units other than steam which were inspected by the inspectors of the bureau were found with defects or errors in inspection which should have been corrected before the locomotives were put back into use. The increase in each case was one per cent as compared with the results during the preceding year.

Four boiler explosions occurred during the year, all caused by overheating of the crown sheet due to low water. They resulted in one person killed and six injured. Three of the explosions occurred on locomotives in freight service and one on a locomotive in charge of a watchman. One of the locomotives in freight service was equipped with a low-water alarm which apparently had functioned, but no testimony was developed to indicate that the warning whistle sounded or was heard by members of the engine crew.

In a second explosion involving a locomotive in freight-train service evidence indicated that absence of a safe water level was known to employees on the locomotive prior to the accident. No defects were found on this or the third freight engine which would have contributed to the accidents.

Fatalities to one person and injuries to 30 others resulted from 31 boiler and appurtenance accidents other than explosions. This is a decrease of 14 accidents, an increase of one in the number of persons killed, and a decrease of 16 in the number of persons injured compared with the preceding year.

The director reports 845 applications filed for extensions of time for removal of flues. Investigation disclosed that in 93 of these cases the extensions could not properly be granted. Extensions for shorter periods than requested were allowed in 8 cases and 35 extensions were granted after defects disclosed by the investigations were repaired. Forty-four applications were cancelled and 645 were granted for the full period requested.

Specification Cards and Alteration Reports

Sixty-one specification cards and 2,277 alteration reports for steam locomotives were filed, checked and analyzed during the year. A total of 3,781 specification cards and 636 alteration reports were filed for locomotives other than steam and 839 specification cards and 267 alteration reports were filed for boilers mounted on locomotive units other than steam.

Recommendations

The director called attention to the fact that the general use of two types of locomotives has increased the responsibility of inspectors and requires that candidates for the position of inspector be men of wider experience and training than was formerly required. He also calls attention to the fact that increases in salaries and improvement in working conditions of men employed by the railways whose duties provide qualifying experience for applicants has caused difficulty in obtaining replacements. To meet these conditions he recommends that the position of inspector of locomotives be allocated to the next salary grade above that now designated.

No formal appeal by any carrier was taken from the decision of any inspector during the year.

Completely rebuilt refrigerator cars at the West Wichita shops of the Santa Fe. All design details are checked to assure minimum maintenance.

Car Design for Reduced Maintenance

Attention to numerous details will produce cars to meet exacting shipper needs and railroad requirements.

By H. L. PRICE*

No subject could be more appropriate in these times of high labor and material costs than designing cars to reduce maintenance. Certainly we need to "beat the bushes" for better designs and materials by and from which to construct cars so that maintenance costs will not become a back-breaking burden. . . .

Competition in the transportation field is so keen and shipper demands so exacting that the time is here, if not past due, for giving shippers conveyances for hauling their product which will be so attractive they will prefer them to any other competitive mode of transportation. The objective then is to furnish cars which will: (1) Provide quick and economical loading and stowing; (2) protect the commodities while moving to destination, without delay or damage; (3) have high availability, remaining in service, doing useful work with a minimum out of service for repair track attention.

A major obstacle to economical maintenance is the old car—20 and more years old. Such cars generally are constructed with obsolete types of roof, have wood running boards, low-capacity draft gears, trucks of poor design that are hard riders, insufficient floor supports and other items that cause this ancient car to spend too much time on the repair track. Even a major repair job cannot be justified to perpetuate such equipment, for no matter how well it is rebuilt the car is still old. Maintenance costs for obsolete designs are inherently higher and may be twice that of modern design cars.

Freight cars over the years have steadily increased in carrying capacity, durability and availability for service. However, even in later-built cars the railroads have not fully recognized, or at least taken advantage of designs that need to be incorporated into the car to prevent damage to the car or its lading.

Floors in cars are generally conceded to be the most costly maintenance item. In spite of this, many new cars are built with 1¾-in. decks and insufficient floor supports. Mechanized loading and use of lift trucks makes it imperative that more strength be built into the car floor through use of not less than a 2⅜-in. deck and two longitudinal floor supports on each side of the center sill between the side sill and center sill. Metal perforated floor plates or equivalent at least in the doorway, if not some distances each side of the door opening, need also to be considered not only as means of adding strength to the floor but as wear protection for the wood deck.

* Mr. Price, who is mechanical assistant, AT&SF, Chicago, presented this comprehensive analysis of present freight car conditions from a design standpoint at the December 8 meeting of the Car Foremen's Association of Chicago.

Ten Important Things To Be Done

1. **Modernize freight cars and dispose of the stagecoach variety.**
2. **Provide stronger floor structures to meet modern loading methods.**
3. **Equip side walls with devices to eliminate anchoring loads directly to the lining.**
4. **Design box cars as nearly vermin proof as possible.**
5. **Attach metal running boards more securely to cars.**
6. **Strengthen side sills in certain types of cars.**
7. **Install automatic brake slack adjusters.**
8. **Improve and simplify truck design.**
9. **Improve the present solid journal bearing assembly or use roller bearings with grease lubricant.**
10. **Design to minimize metal corrosion particularly in gondola and hopper cars.**

This protection is particularly necessary in the door area.

In spite of dynamic braking with modern diesel power there are still too many fires in wood floors due to brake shoe sparks. There is a need for spark shield installations to eliminate costly repairs and heavy damage claims from this source.

A word of caution about application of the perforated floor plates. Poor or careless laying of these plates leaves humps under which grain accumulates and sours. The odor is objectionable. Furthermore an ideal place is created under the floor plates for weevil infestation. Also accelerated rotting of the decking can result. The cure is better shop practice in laying the floor plates and use of some kind of sealing compound between the wood deck and the steel floor protection plate.

Composite wood and steel decks are also being tried out as are the all-steel floors. The test of time and service will determine the merits of each. High floor maintenance warrants full investigation of any substitute that offers reduction in that cost.

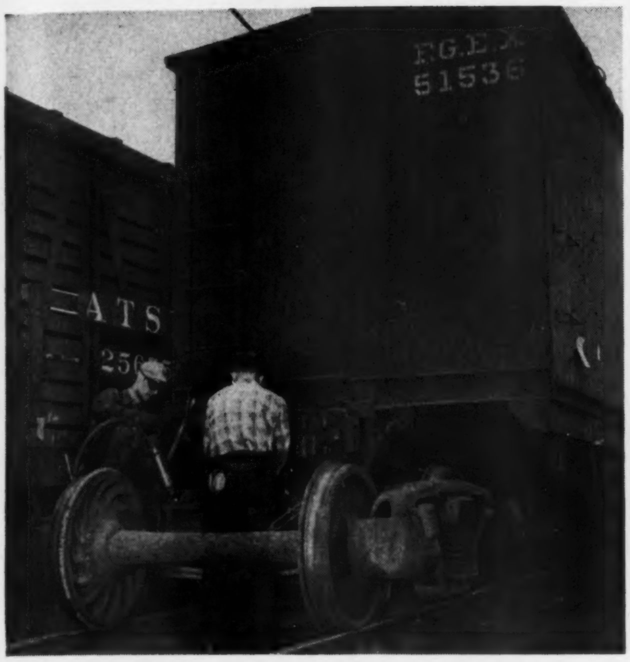
While purchasing departments specify and endeavor to obtain lumber with minimum moisture content, the fact remains, that a large portion of the new decking going into box cars today is a far cry from the kiln-dried material the car builders desire. After the car is in service a short time the deck boards dry out and large cracks open in the floor. To facilitate repairs necessary to close up the deck the use of floor clips in the original installation will reduce the time and cost. A considerable labor saving is also realized in the original installation when floor clips are used in that the boards can have the bolt holes bored on multiple-boring machines in the mill, eliminating laborious overhead single-hole boring.

Lining repair costs have usually been a close second to floor repair costs. On grain-carrying roads where expendable grain doors such as the paper door are preponderently used, lining repairs to box cars threaten to surpass the cost of deck repairs. Bulkhead installation or steel strapping applied to the lining also exacts a heavy toll in broken and damaged lining boards. The approach to this problem is through two sources: (a) Installation of lading anchors on the side posts of cars in sufficient quantity and in proper locations to provide freight houses and shippers with a means to anchor or tie the lading down without resorting to driving large nails in the $^{13}/_{16}$-in. lining. (b) Proper design of wood door post to which the expendable grain door can be attached.

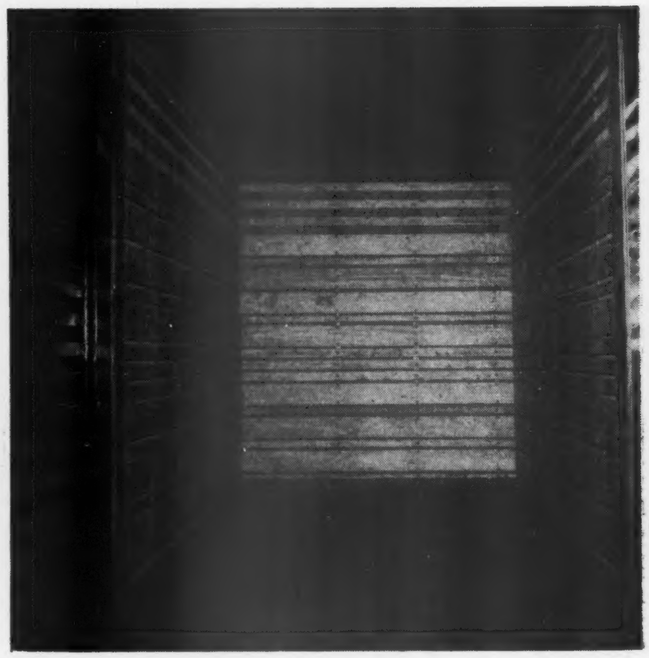
Whether we like it or not the wooden grain door is passing out of the picture in the grain areas of the central west. If for no other reason than cost alone, the paper grain door or similar substitute is here to stay. With this type of door the 4-in. wood door post is too narrow to receive all the necessary nailing of the paper door, when fully stretched. The result is that large anchor nails are driven into the side lining and when the anchors are later removed they literally tear out chunks of the lining a few inches from the end of the lining board and adjacent to the door post. Costly renewals of lining in comparatively new cars results. To prevent this damage a new design of wood door post $10\frac{1}{2}$-in. wide is needed. This, of course, results in shorter lining boards. The wider door post with renewable grain door nailing strip provides a solid anchorage for paper grain door nailing and as previously stated, allows shortening of the lining to beyond the nailing area. Tremendous saving in car lining can result from installing of lading anchors and proper design or door posts along with a good educational campaign among shippers to acquaint them with the proper use of these devices.

While discussing wood decking and lining we must remember one of the objectives I mentioned previously and that is to move the commodity to desination damage free. In the grain country we hear a lot about weevil infestation. Much money goes into paying damage claims on account of cereal products damaged by weevils and several measures have been, or are are being taken, to eliminate that trouble. There is the hinged and lining and removable sections of both the end and side lining, all designed to facilitate cleaning out behind the lining. There is also, the use of fibre glass behind the end lining as an insect repellent. The single-sheathed wood car of 20 years ago probably gave less trouble from weevil infestation than the conventional wood or steel sheathed car with wood lining. Why not take a lesson from the single-sheathed wood car of yesterday and build a liningless steel car? By liningless, I mean a car without full lining from floor to ceiling—a slatted type of lining. Certainly it would help eliminate the weevil problem, and with proper study and trial could be developed into an all-around, general-purpose car. Use of slats on both the sides and ends, with inside edges rounded, of course, spaced about an inch apart and with the usual lading anchor arrangement would make the car suitable for most commodities now shipped in box cars. It would be self clearing when loaded with grain. Cleaning and blowing of and behind the slats could be simply and thoroughly accomplished when preparing the car for flour.

While still on the subject of the interior of the car there is the problem of condensation on the ceiling and consequent drippage onto the lading. Several materials are made and sprayed onto the ceiling to prevent this. These seem to have been fairly successful though recent claims of damage have appeared as a result of leeching, or actual softening and running of the material on account



Freight cars on the Santa Fe repair track at Argentine, Kans. Truck repairs are perennial but many car parts would last longer if properly designed.



Santa Fe specially lined box car, built new at Topeka shops and designed to be self-clearing after grain loads.

of fumes from penta-chlorophenol treated material shipped in the cars. I merely mention this in passing that we may not be too complacent that our present car ceiling insulating materials are all that is desired.

Wood running boards have always been a costly maintenance item. I believe we all recognize that the metal running board is the solution to that problem. However, even the metal board is subject to criticism at the present time due to loose and missing bolts and even missing sections of running board. To overcome this a full riveted application is necessary, not only the saddles to the roof, but the running board to the saddle. This manner of application will reduce maintenance, and also avoid much justified criticism by safety appliance inspectors on account of loose or missing bolts.

Present all-steel riveted roof, steel sides, side doors and A.A.R. underframe appear adequate with the exception that we are not always providing sufficient side sill and body bolster strength especially where a greater portion of the load is carried by the side sills as in the case of perforated side wall (PD lining) cars. This is a design problem that needs careful watching, not only with new cars but in conversion jobs. Much unnecessary patching and later reinforcement can be avoided by sound engineering initially.

In spite of great advancement in design of the steel end we still experience too much trouble with bulging car ends. There is no logoical reason for so much time of the car repair forces being consumed in straightening steel ends and replacing the lining.

AB brakes, power hand brakes, and manual slack adjusters are contributing a great deal to reduced maintenance. Automatic slack adjusters when perfected will further that reduction. They will also expedite the servicing and testing of trains for departure from train yards.

It is generally conceded that the present cast steel integral journal box truck with built-in snubbing devices is doing a good job. However, the tension member with the upright U-section is a catch all for dirt, coal, etc., and if not cleaned out frequently can result in accelerated corrosion. This member should be designed of inverted U-section insuring longer trouble free life. Proposed new A.A.R. Rule 24 tightens up on the permissible corrosion limits. The least movable parts of which a truck can be designed is desirable. There are just that many less parts to wear and fail. The truck side recessed type of brake beam suspension frequently referred to as unit type is a step in that direction, as it eliminates a large number of parts such as hangers, pins, and the various brake beam safety carriers. This must not be considered only from a reduced maintenance standpoint alone, but from that of safety of operation.

As good as present design trucks are they are still incapable of fully meeting the service demands imposed by today's railroad operation. Higher speeds and longer runs inherent with diesel operation have tended to obsolete the freight car truck as we know it. Until we come up with a truck including its bearings, that is truly a high speed freight car truck we present a stumbling block, and a hazard to good freight train performance. This freight-car truck design with its poor performing bearings prevents the railroads from seriously challenging competitive trucking concerns.

[Mr. Price here referred at some length to hot boxes which sometimes almost paralyze railway operation and said perhaps roller bearings are the solution but, in the long transition period, solid bearings must be lived with and two approaches offer relief, namely elimination of waste in supplying lubricant to the journals and use of Statco type bearing metal with a melting point 150 deg. higher than ordinary babbitt metal. He said the higher initial cost will pay dividends. Mr. Price also called attention to promising experiments with mechanical refrigerator cars equipped with metal floor racks, membrane floor covering, fireproof insulation, lading anchors in walls and bulkhead electric circulating fans. He said flat cars and gondolas as also should have lading anchors applied to side and end sills and both gondola and hopper cars details need special attention to prevent corrosion.—Editor.]

What Is Fuel for Diesel Locomotives?*

An appraisal of the qualities of diesel oil and a description of tests by which they are measured.

By LOUIS E. TALBOT†

THE last few years have brought a tremendous increase in the use of the diesel locomotives to replace the steam locomotives. Fuel economy has been the major driving force in the expansion of diesel-engine use, and whether or not this advantage is maintained may well depend on the most critical evaluation of the several fuel qualities considered desirable for diesel engines. It is the purpose of this paper to present some of the inspection tests made on diesel fuels and to evaluate each as to its importance.

Gravity Test API

The gravity of an oil is found by allowing a standard hydrometer to float in a cylinder of the liquid whose gravity is to be determined. After proper temperature corrections are made, the reading is usually reported in degrees, API. The API of an oil varies inversely as the specific gravity. The approximate heat of combustion of the fuel in question is almost a direct function of the gravity. That is, the higher the API gravity, the greater the heat of combustion or amount of heat liberated per pound of oil during the combustion. The API gravity also shows the degree of paraffinicity in that a high gravity for any given boiling range indicates more paraffin compounds.

Distillation Range

The distillation test generally indicates the volatility characteristics of the fuel. It is made using a distillation apparatus to vaporize the fuel, then condensing it into a graduated cylinder at the same time recording the temperatures as each successive 10 per cent distills over. The temperature at which the first drop distills over is called the initial boiling point (IBP). If the IBP is too low, the fuel will ignite, then go out before the balance of the fuel can ignite; however, if the succeeding fractions are close enough to the IBP, no trouble should occur. On the other hand, if the IBP is too high, one can expect trouble in starting the engine especially at low ambient temperatures.

The next temperature point studied above the IBP is the 10 per cent distillation point. The spread between the IBP and the 10 per cent point should be relatively small so that the fuel will continue to burn once ignition has started. The 50 per cent distillation temperature point is used to check the spread between the IBP and the end point (EP), and is also used to calculate the cetane number which will be discussed later.

The 90 per cent distillation temperature point is a good indication as to what degree complete vaporization in the combustion zone may be expected. End points which are unusually high are especially objectionable, and result in poor combustion and carbon deposits in the engine. Usual specifications for diesel locomotive fuels include a 675 deg. F. maximum end point temperature.

Most of the properties of diesel fuel vary with the distillation range, therefore, when comparing other test, similarity in boiling range should be studied first.

Viscosity Test

The viscosity of an oil is the measure of the oil's resistance to flow and is sometimes referred to as consistency. The viscosity is determined by the length of time, in seconds, required for a certain amount of oil, at a given temperature, to flow through a standard orifice tube. Viscosity appears to be a function of the average boiling point of the fuel mixtures and should not be specified until the boiling range has been established. If we are to have real control of injector timing, of the quantity of fuel injected, and of the shape of the spray formation, the viscosity of the fuel must be controlled within reasonable limits. Ordinarily fuels of low viscosity give fine atomization with broad dispersion of the spray, but short penetration. Higher viscosity fuels offer greater resistance to atomization causing the larger fuel particles to have greater penetration with corresponding loss of dispersion. Also the viscosity of a fuel should be high enough to provide some lubrication as the moving parts of the fuel pump itself are lubricated by the fuel oil. The viscosity for diesel locomotive fuel usually will be in a range of from 32 to 40 Saybolt seconds at 100 deg. F.

Cetane Test

The cetane test is made to determine the ignition quality of the fuel; it is made using a single-cylinder engine of continuously variable compression ratio, with suitable loading and accessory equipment, and mounted on a stationary base. The cetane number of the diesel fuel is determined by comparing its ignition quality with those for blends of reference fuels of known cetane numbers at 900 r.p.m. This is done by varying the compression ratio for the sample and each reference fuel to obtain a fixed "delay period", that is, the time interval between injection and ignition. When the compression ratio for the sample is bracketed between those for the two reference fuel blends differing by not more than

* This paper, under the title, "Evaluation of Diesel Fuel Tests," was presented at the annual meeting of the Railway Fuel and Traveling Engineers' Association, held at Chicago, September 15 to 17, 1952, inclusive.

† American Petroleum Institute.

Gravity discloses the approximate heat content.

Distillation Range is an index to most of the properties of the fuel.

Cetane Number is an index of ignitability of fuel.

Pour Point is important where low temperatures are encountered.

Ash Content tells how dirty the fuel is.

Carbon Residue. Low volability component break down and tend to foul the engine.

Sulphur in some compounds is less corrosive than when present in other compounds.

Flash Point, not significant in engine operation, is important from a safety standpoint.

Color has no relation to quality.

Water and Sediment, even in small amounts, cause trouble, particularly at low temperatures.

five cetane numbers, the rating of the sample is calculated by interpolation. The cetane index which is comparable to the cetane number may be calculated by the following equation:

C.I.=175.4 log‡ (M.B.P.)+1.98 (API Gravity)—496

Low cetane numbers indicate that the fuel will not ignite as quickly after injection as a fuel of higher cetane volume. Slow ignition (low cetane fuel) makes the engine harder to start when cold, and makes it run unevenly especially when idling or at light loads. Fast ignition (high cetane fuel) promotes easy starting and smooth running. However, there is no advantage in using fuels of higher number than that required for easy starting and smooth engine operation. Cetane numbers for diesel locomotive fuels will range upward from 40, although at the present time most railroads specify a 50 minimum cetane number.

Pour Point

The pour point of a fuel is the lowest temperature at which the fuel will flow or pour. The test is made by subjecting the fuel to a cold bath which lowers the temperature at a given rate until the fuel no longer flows. The pour point is taken as the temperature 5 deg. F. above this solid point.

There are two methods employed in lowering the pour points of diesel fuels; one is a reduction in the paraffin content of the fuel and the other method is to add pour-point depressants. If we use the "paraffin reduction" method we reduce the cetane number of the fuel. It then becomes a question as to which is more important, the cetane number or the pour point. If we use the pour point depressants, we raise the cost of the fuel so again we have a problem. It can be seen from the above, that the importance of the pour point of a fuel will differ depending on the locality; railroads operating in cold climates will naturally have more trouble than those operating in warmer climates.

Ash Content Test

The ash content of a diesel fuel is usually quite small. It is determined by igniting the fuel and allowing the fuel to burn completely; then placing it in a muffle furnace until all carbonaceous matter has disappeared. Large values of ash reflect improper finishing in the production of fuels, particularly where treating steps are involved. If the fuel contains dust, sand, and other foreign materials, usually due to improper handling, scoring of injectors, cylinders, liners, and bearings can be expected.

Carbon Residue Test

The carbon residue of a diesel fuel reflects the presence of high boiling or rather extremely low-volatility components present. They crack down to a carbonaceous residue at the distillation temperature of the fuel. A carbon residue value on diesel fuels is always determined on the 10 per cent distillation residue in order to increase the accuracy of the test. The components causing high carbon residue may be expected to increase engine deposits due to their inability to vaporize. A diesel fuel of good quality will usually have a carbon residue below 0.05 per cent on the 10 per cent distillation residue.

Sulphur Test

The amount of sulphur in a diesel fuel may be determined by burning the sample in a closed system, using a wick type lamp and an atmosphere of sulphur-free air. The oxides of sulphur produced are absorbed and oxidized to sulphuric acid by means of hydrogen peroxide and determined gravimetically as barium sulphate.

All fuels normally contain some sulphur; however, it appears that the type of sulphur compounds present rather than the amount of sulphur is the determining factor as to whether or not sulphur-fuels are corrosive. High-sulphur (corrosive) fuels cause engine wear, corrosion, and engine deposits. To rid the diesel fuels of harmful sulphur compounds involves an increase in the cost of the fuel. The problem then becomes, how much does it cost the railroads in maintenance due to corrosion or deposit formations in relation to the added fuel cost? At present the sulphur content of most of the diesel fuels used by the railroads is under 0.50 per cent.

Flash Point Test

The flash point of a fuel is considered as having no significance in diesel engine performance. It is used primarily as a safety measure since it represents temperatures at which fuel will flash in the presence of flame.

When considered in connection with the distillation range of the fuel, it gives some measure as to the degree of fractionation applied in separating the diesel fuel fraction from lower boiling materials. For example, in

‡ M.B.P.—Mid boiling point in deg. F. of the fuel in question.

fuels having the same initial boiling points, but with different flash points, the lower flash represents poorer fractionation. Most railroads usually desire a minimum flash point of 150 deg. F. as determined by the Pensky Martens closed cup method.

Color Test

The color of a fuel has no relation to its quality. Color of diesel fuels range from water-white to a dark amber. Some refineries color their fuels with dyes for easy identification.

Water and Sediment Test

Water and sediment as determined by the centrifuge method reflect for the most part the care taken in the finishing and handling operations employed in preparing the fuel for the engine. By far the greatest cause of water and sediment contamination is careless handling in the field. Water and sediment in the fuel are highly objectionable and every effort should be made to prevent contamination from this source. Even small amounts of water in solution will cause serious trouble at fuel temperatures below 32 deg. F. by freezing out as ice crystals, which then plug the fuel filters and may completely stop the flow of fuel to the engine.

Electron Microscope

Ray McBrian of the D&RGW was the first to utilize the electron microscope in the study of railway diesel fuel. The image is observed on a screen coated with material which emits light under electron impact. To obtain a permanent record, this fluorescent screen may be photographed externally, or a photographic plate may be exposed directly to the electrons. Owing to the smaller size of the electrons, as compared with light waves, much finer details can be appreciated in the electron than in the optical microscope. Although still in the experimetnal stage, the electron microscope is now being used by the D&RGW in the studies of diesel fuels, and offers a better understanding of many of the problems encountered in the operating conditions and problems arising from the use of different fuels.

Significance

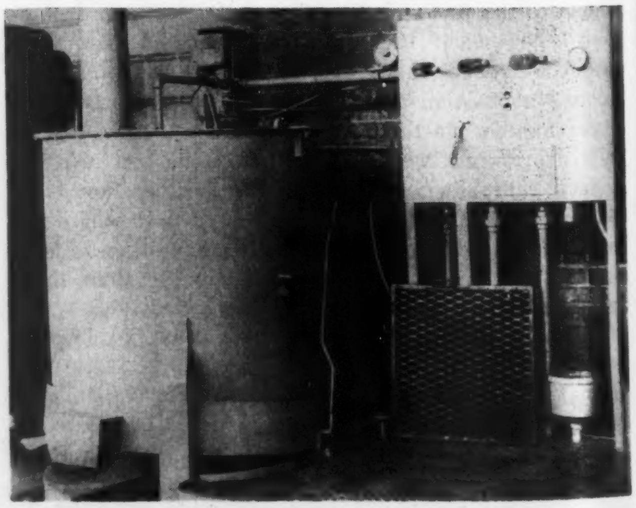
These diesel fuel tests and their significance may be summarized thus:

1. Before the final specifications on diesel locomotive fuels can be written, a complete cost analysis must be made; that is, in purchasing the better grades of fuel, does the increase in the cost of the fuel offset the high maintenance cost which probably would occur in using a poorer grade of fuel?
2. It can be seen that no one test alone determines the quality of a diesel fuel, but rather the collected data from 12 different inspection tests.
3. It should be noted that while the actual conduct of these inspection tests appears to be simple their proper evaluation is quite complex; therefore, they should be run only by the qualified personnel of the various testing laboratories.

High Production Air-Filter Cleaning

EXCEPTIONALLY satisfactory results are being secured with the centrifugal air-filter-cleaning machine, illustrated, which is installed in a large midwestern railway diesel servicing shop and takes care of this requirement currently for about 236 road freight and switching units. The air filters are pre-washed with hot water, thoroughly sprayed with a cleaning solution, rinsed with hot water, spun dry with the help of compressed air and finally given an even coating of oil without excess. The entire operation for a single loading of four filters in the machine averages not over 2 min. At the shop mentioned, roughly 250 to 300 air filters are washed and oiled in about five hr. a day by one man who is thus available part time for other work.

By way of comparison, the method formerly used involved boiling filters in a caustic solution for 45 min., removal and hand rinsing with a hose, hand dipping in an oil tank, draining and baking for 10 hr. This process took one man on each of three shifts to keep up with the



Safe-N-Ezy air-filter washer-oiler set to drain cleaning solution back into the tank for re-use.

Loading filters in the washer-oiler—Cylindrical pan set to drain rinse water to the sewer.

work; the cleaning and oiling were not always up to standard; and from 400 to 600 extra filters had to be stocked to avoid holding expensive diesel units out of service while air filters were going through the long process of being reconditioned.

Method of Operation

The general method of operating this air filter washing and oiling machine, which is made by the Paxton-Mitchell Company, Omaha, Neb., is as follows: Four 19½-in. square air filters are placed in the rotor basket at the same time, or a larger number of narrower filters may be included. Rotation of the basket throws these filters outward against a cylindrical basket where they are held without any clamping. A cone-shaped bottom on the basket keeps the filters tilted slightly outward at the top and prevents their falling to the center when the basket is stopped or just starting.

Oil, air cleaning solution and hot water are introduced by three separate vertical pipes, two being near the center of the basket. One of these has a series of small perforations extending practically its entire length for spraying air, cleaning solution and water on the filters under high pressure by opening or closing suitable valves. Oil is sprayed on the filters through small nozzles set in the second pipe. Thus the filters are sprayed with an even coating of oil aided by centrifugal action and compressed air.

An even and thorough coating of all the filter elements is assured and all excess oil avoided by applying 6 ounces as measured by the small fluid meter just at the left of the control board.

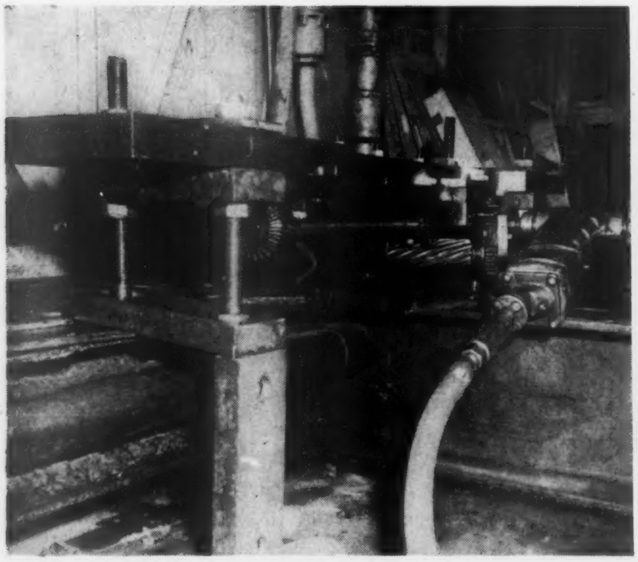
A third pipe which is perforated in the same manner as the center pipe extends down the outside of the rotating basket for washing, flushing and spraying oil on the outer faces of the filters. Cleanout traps are installed on the bottoms of the perforated pipes. The oil spray nozzles are of the ball-seat type which iliminates drip and applies uniform spray of oil on the filters.

The necessary air, hot-water, solution and oil shut-off valves are conveniently installed on a control board, also a pressure gage and start-and-stop buttons for the 5-hp. electric motor which drives the rotor basket through suitable gear reduction. The high-speed rotary liquid circulating pump furnished has a capacity of 30 gal. a min. and the gear-type oil pump 1½ gal. a min. A divided tank underneath the machine has a capacity for 10 gal. of oil and 35 gal. of solution. The tilting cylindrical pan immediately under the washer is operated by a long vertical hand lever shown on the front of the machine. When this lever is moved to the left the cylindrical pan tips forward and drains rinse water to the sewer. When the lever is moved to the right, the pan tips back and cleaning solution drains back into the solution tank to be used over again. Since only the correct amount of oil is sprayed on the filters no provision for oil drain is required.

Washing Solution

The filter washing solution used in this instance consists of 8 lb. of Oakite No. 24 to 30 gal. of water. The tank is cleaned out every night and the solution renewed daily. The diesel lubricating oil used, No. 50, was wasted to a considerable extent when this machine was first installed owing to difficulty in knowing when just enough had been sprayed on the filters. Guesswork regarding this detail was eliminated by installing the fluid meter, illustrated, and experimenting until it was determined that six ounces would produce desired results in the four 19½-in. square filters and leave no excess.

Adequate filter-handling facilities to minimize manual labor are important and in some shops consist of lift truck skids, whereas in others, light, mobile filter racks, made of welded tubular steel and supported on easy turning wheels, serve to receive full sets of air filters from individual diesel units, readily move them close to the washing machine and be loaded with sets of clean filters for prompt return to the units.


The portable milling device in operating position.

Portable Diesel Bed Plate Miller

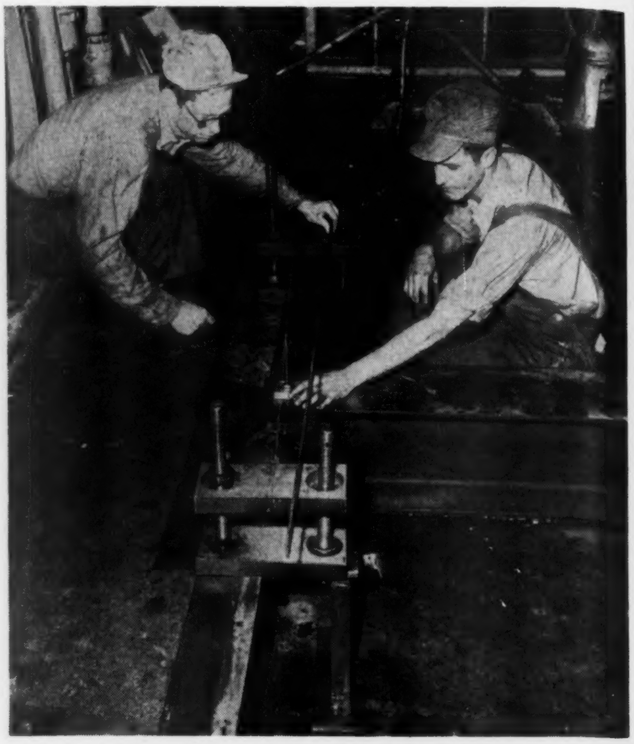
A portable milling device has been developed at the Spencer, N. C., shops of the Southern for milling diesel engine bed plates that have become misaligned, and for milling steam locomotive pedestals. The detail illustration shows the construction of the attachment and the method of application for milling steam locomotive pedestals. The photograph shows how the miller is used to align diesel bed plates with the use of a top rail to which it is connected for horizontal milling through $\frac{5}{8}$-in. studs on the bed. The top rail is $66\frac{1}{2}$ in. long and $1\frac{3}{4}$ in. thick. It supports and guides the milling cutter along a true horizontal path. The milling cutter is driven by an air motor through a tapered shank. The feed is automatic through a worm and bevel gear drive and a feed screw nut. Also provision is made for hand feed.

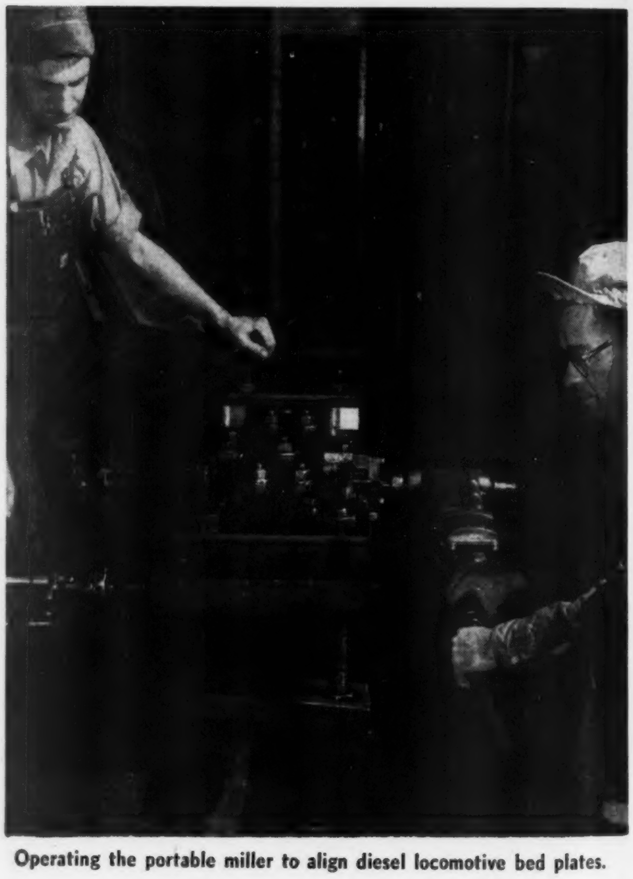
To mill diesel bed plates, two steel wires are run, one over the right pair of bed plates and one over the left. These are levelled using the center plates as guides, with each end of each wire a predetermined distance above its respective center plate. The lowest point on any of the four bed plates is determined, and all bed plates machined to this level.

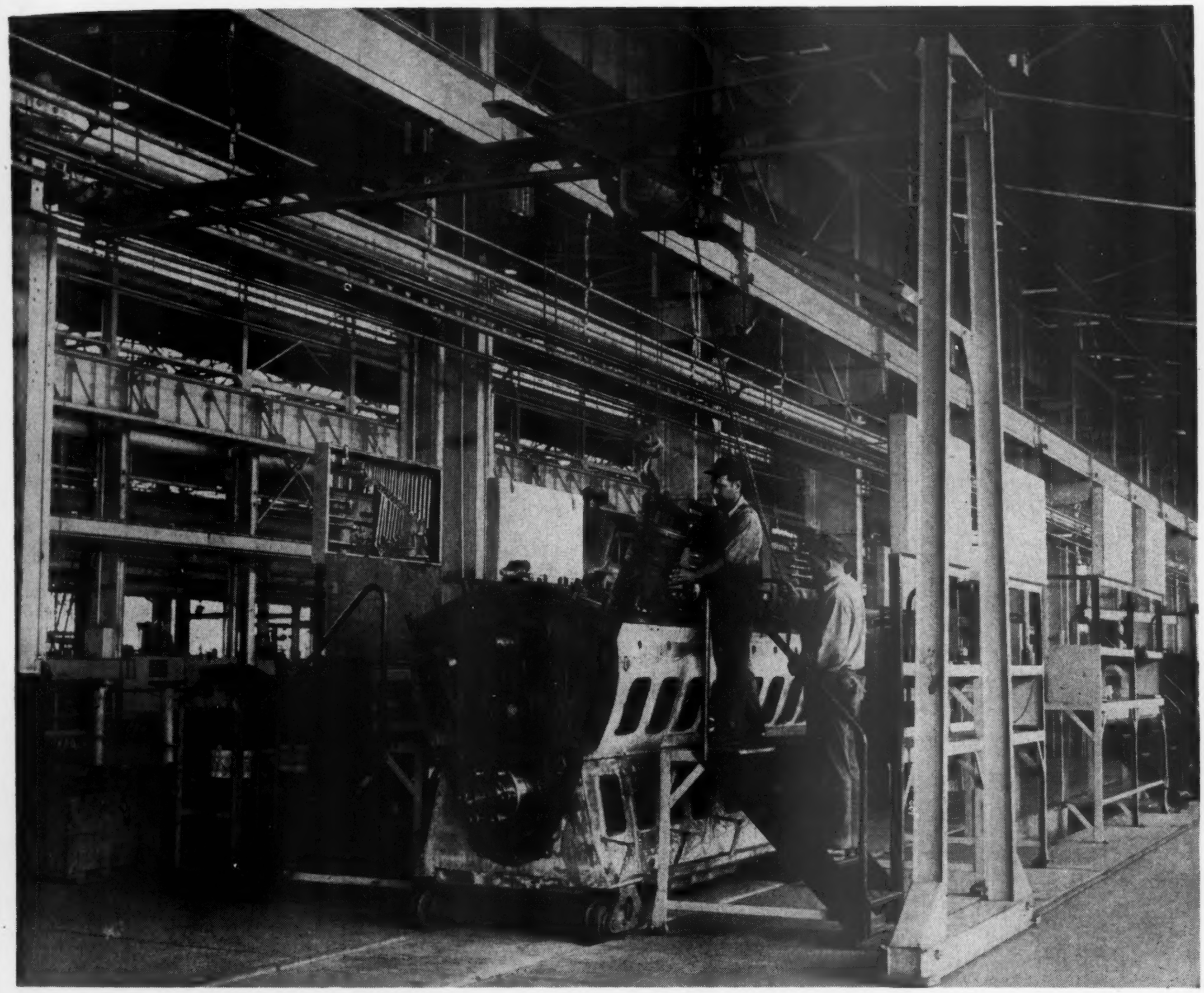
The first step in the milling procedure of each bed plate is to weld two plates 1 in. by 4 in. by 15 in. to the locomotive frame, one on each side of the bed plate to be milled and about 15 in. from it. Two $1\frac{1}{8}$-in. studs are welded to each plate. A filler plate $1\frac{1}{2}$ in. by $4\frac{1}{2}$ in. by 11 in. has two holes and slips over the $1\frac{1}{8}$-in. studs. The holes in the filler plate are counterbored for a nut. A second nut fits each stud between the top of the plate welded to the frame and the bottom of the filler plate. The two nuts on each stud on either side of the filler plate make fine adjustments up and down for the attachment. Rough adjustments in $\frac{1}{32}$-in. increments are made by shims between the top of the filler plate and the bottom of the top rail which is later placed on the filler plate.

After the two filler blocks have been set to the height of the lowest point on the bed plate surfaces and levelled to the guide wires, the top rail is slipped over the two pairs of studs. The slots in the top rail are $1\frac{1}{4}$ in. by 11 in., the length being to adjust for slightly different locations to which the stud plate may be welded.

For steam locomotive pedestals, the attachment without the top rail is supported on a suspension bracket. A filler piece straight on one side and tapered on the other to the taper of the wedge is clamped in place. This piece has holes to mate with the same studs on the bed to which the top rail was bolted.


Aligning the base plates for the guide of the miller.


Operating the portable miller to align diesel locomotive bed plates.

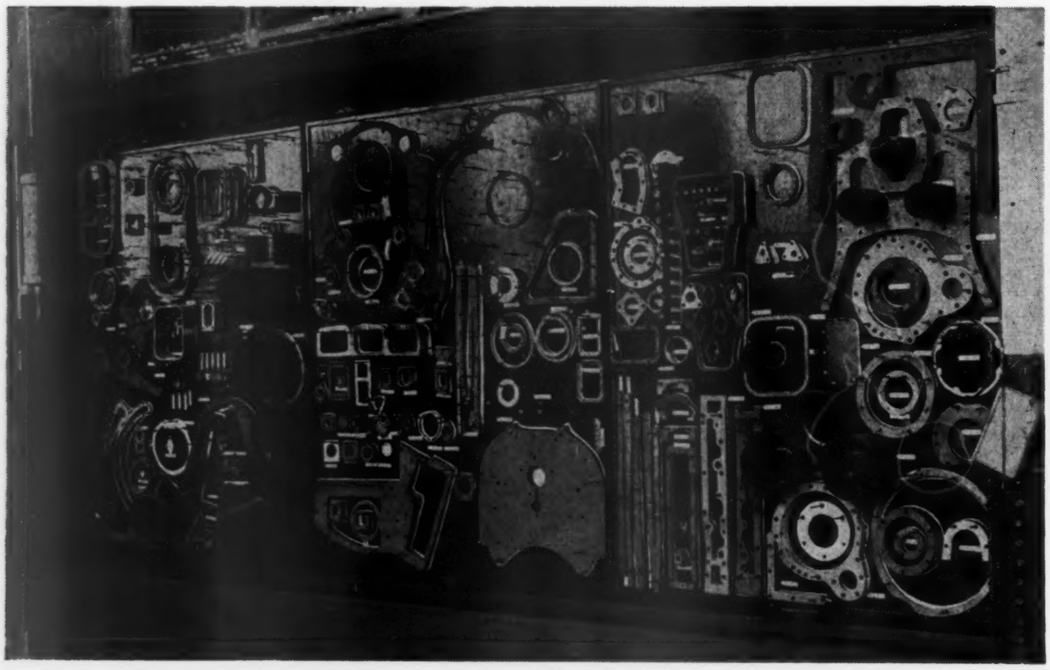


Engine assembly position. Note one-ton one-leg gantry crane, small tool racks, working platform on rollers for moving in or out to accommodate engines of different widths and lifting device that positions cylinder assembly 22½ deg. off vertical.

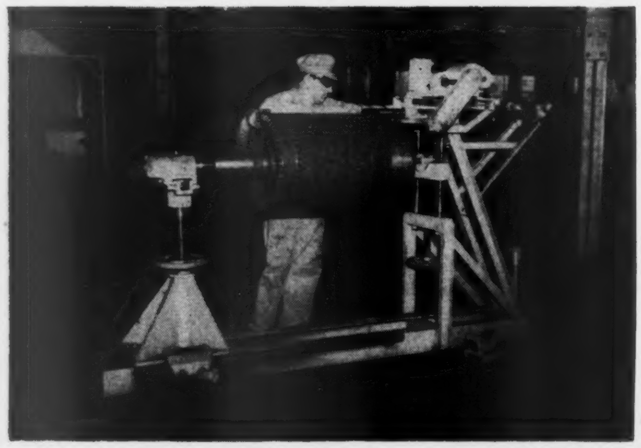
B. & O. Glenwood Diesel Shop . . .

PAGES 63-69 of the January issue presented a picture story describing the Baltimore & Ohio diesel shop at Glenwood (Pittsburgh), Pa. These pages supplement that story with additional photographs showing some of the equipment and devices that help to keep production rolling in this centralized repair center for diesel freight units.

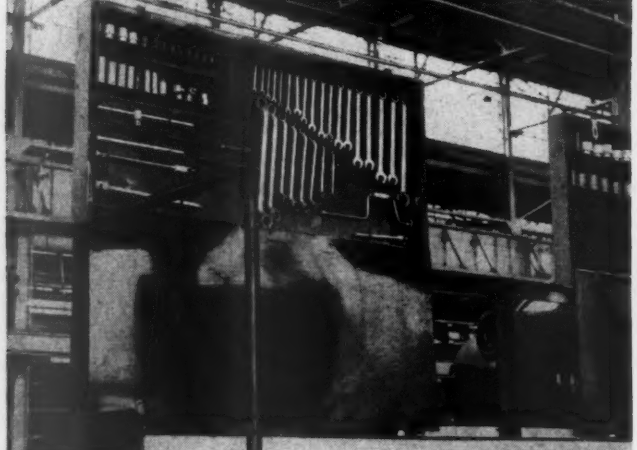
Electrical parts are spray painted in a booth equipped with exhaust system.



Three - section board holds gaskets on both sides. Each section rotates on ball-bearing center supports.



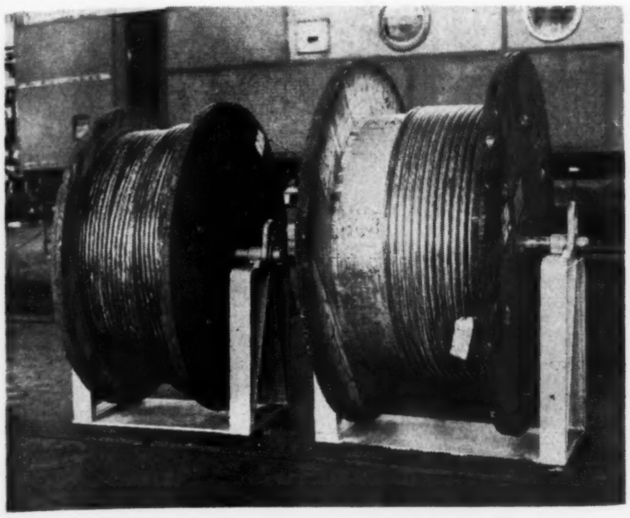
Machine for undercutting mica insulation after commutator has been reground.

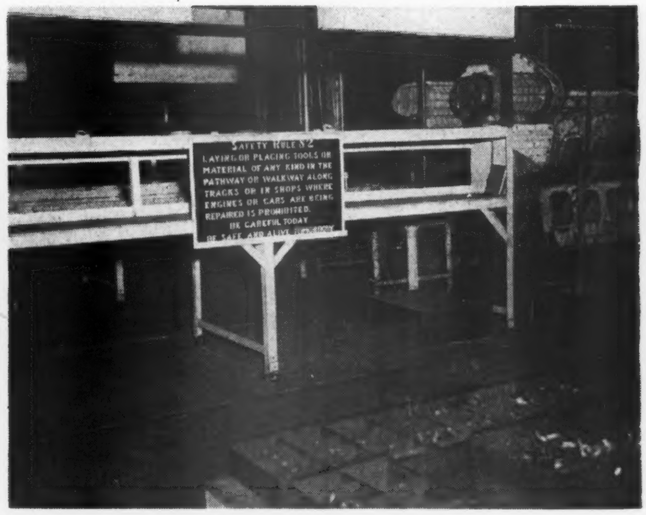


Small tool racks located on platforms both at engine disassembly and assembly stations eliminate many trips to tool room.

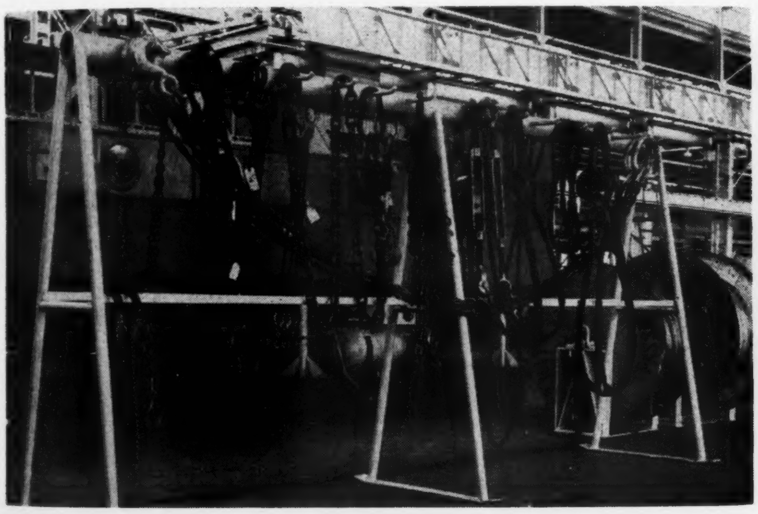
Traction motors are supported on tables at a convenient working height. Motors are dismantled and the frames are cleaned and painted. Armatures are cleaned, dried, varnished, baked and balanced.

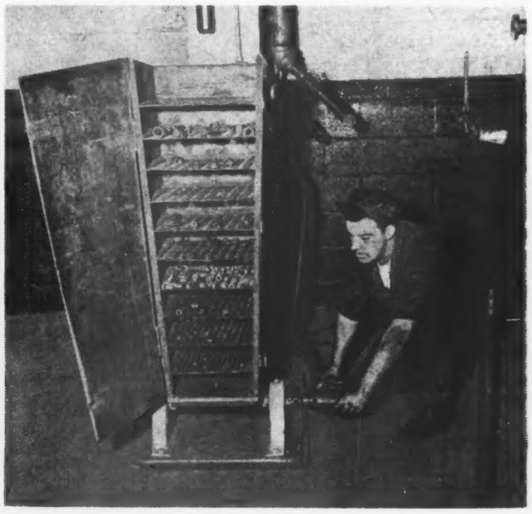
B & O Diesel Shop at Glenwood . . .



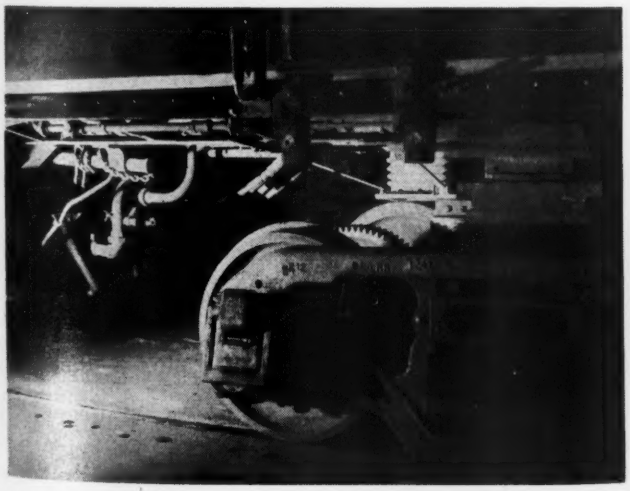


Left:—Wire reels are mounted on special stands. Right:—"Be careful today—Be safe and alive tomorrow." Safety rules are displayed prominently throughout the shop as a constant reminder that accidents are caused by carelessness.



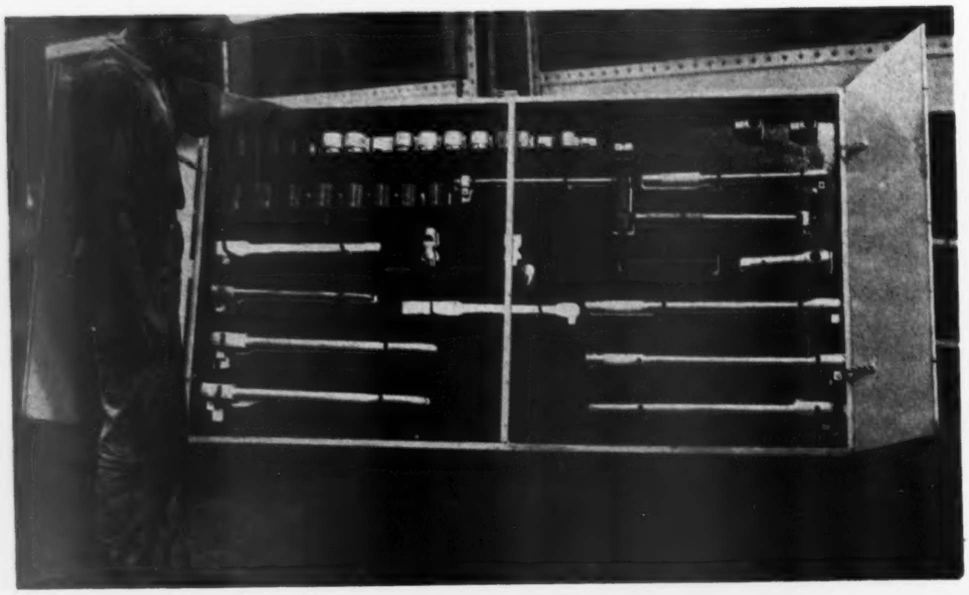


Left:—Crane slings are hung on special rack made of pipe welded together. Right:—Nuts and washers are sorted through perforated plates. Sorter is vibrated by rotating cam at bottom. Air motor shown has been replaced by ½-hp. electric gear-head motor.

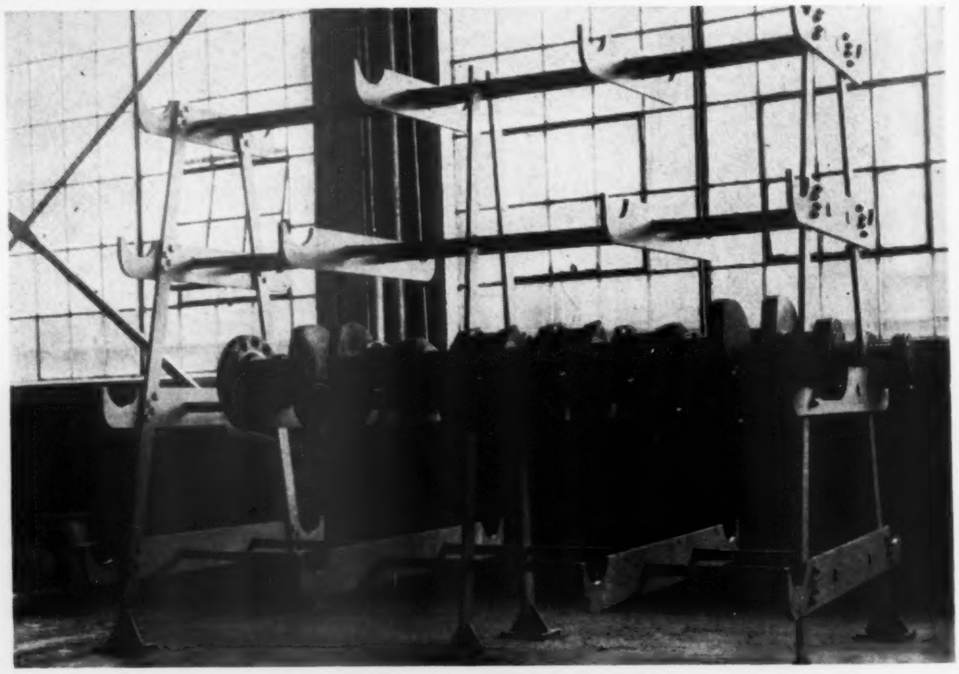


Left:—Diesel bodies are mounted on temporary trucks in shop with one truck powered by air-motor driving ring gear for movement to cleaning position outside of shop. Other truck has air brakes. Air lines are not affected by cleaning solutions. Right:—Injectors are re-conditioned in dust-proof room which also handles work for outlying points.

B & O Diesel Shop at Glenwood . . .



Tools mounted in rack on cart can be moved easily to job at any spot in shop.



The crankshaft rack has two adjustable center supports to suit any type of shaft. Shaft supports are bronzed and machined to prevent damage to finished surfaces.

Movement of heavy parts is speeded by trailer carts hauled by platform trucks.

Questions and Answers

Diesel-Electric Locomotives*

ENGINE TEMPERATURE SWITCH (ETS) OPERATION (*Continued*)

727-Q.—What takes place as the brush arm of the rheostat turns?
A.—As the brush arm turns, it removes resistance from the clutch field circuit, allowing current to flow through the clutch field.

728-Q.—What results from this flow of current?
A.—Magnetic flux lines are set up, through which the engine driven half of the coupling is rotating.

729-Q.—Does this affect the other half coupling in any way?
A.—Yes. Both halves of the coupling are now magnetically attracted to one another and the engine driven half drives the other half through magnetic attraction.

730-Q.—At this stage, do both halves of the coupling revolve at the same speed?
A.—Not at this time.

731-Q.—Explain the reason for the difference in speed between the two halves?
A.—Only a small amount of resistance has been removed from the clutch field circuit, and the current through the field will be comparatively weak. The magnetically connected halves will not revolve in unison.

732-Q.—How is the current flow increased through the field?
A.—As the radiator fan relay motor continues to drive the brush arm, more resistance is cut out of the clutch field circuit and current through the field increases.

733-Q.—What happens as the current increases?
A.—As the current increases, the magnetic field increases in strength, and the slippage between the coupling halves decreases.

734-Q.—What is the result of this decrease in slippage between the two coupling halves?
A.—The radiator fan rotates faster, although there has been no increase in speed of the coupling half which is engine driven.

735-Q.—What would happen in the event that the rheostat removes too much resistance from the clutch field?
A.—It would result in excessive radiator fan speed.

736-Q.—How is this operation stabilized?
A.—A heating element is used to stabilize the operation of the radiator fan relay and to prevent the rheostat from removing too much resistance from the clutch field.

737-Q.—How is the heating element connected to the fan relay motor field?
A.—It is in series with the fan relay motor field, and when contacts meet to energize the motor, they also cause current to pass through heating element.

738-Q.—What then takes place?
A.—The element heats a bi-metal strip, which, as it heats, presses against the movable contact arm and opposes the action of the bellows piston.

739-Q.—What happens eventually?
A.—The bi-metal presses against the arm with enough pressure to overcome the bellows motion and the movable contact is forced away from the stationary contact, breaking the motor field circuit which stops the motor and rheostat.

740-Q.—How would the temperature control be affected if this stabilizing action was not available?
A.—This stabilizing action is necessary, otherwise wide temperature differential would result if the movable contacts reacted only to bellows control.

741-Q.—Explain this further.
A.—Without stabilizing action, the motor would remain energized until declining water temperature caused a retraction of the bellows piston.

742-Q.—What would the radiator fan speed be by this time?
A.—By the time this occurred, the fan relay motor would have caused the rheostat to increase eddy current clutch excitation until the radiator fan was revolving at it's maximum speed.

743-Q.—What would be the result?
A.—Water temperature would drop rapidly before the fan relay could de-energize the clutch and stop the fan. Stabilizing stops this "overshooting."

744-Q.—What mechanical action takes place when the bellows cause the motor to operate the rheostat?
A.—The latter's shaft extension turns cams, which affect the operation of the rheostat motor and the shutter magnet valve.

745-Q.—How do the cams affect the operation of the motor and the shutter magnet valve?
A.—The cams operate three contacts. The middle one affects the shutter magnet valve. Operation of the other two limits the operation of the motor.

746-Q.—What takes place at initial movement of the rheostat?
A.—The initial movement of the rheostat opens the middle contact, and the shutter magnet valve (SMV) is de-energized.

747-Q.—What happens when *SMV* is de-energized?
A.—The radiator shutters are opened.

748-Q.—What action follows?
A.—The top contact then closes, permitting the rheostat motor to operate in reverse whenever decreased clutch excitation is required.

749-Q.—When will the bottom contact open?
A.—The bottom contact will open only when the rheostat has been turned to the extreme end of its travel.

Schedule 24 RL Air Brakes

SPEED-GOVERNOR CONTROL (*Continued*)

1501-Q.—What additional devices are necessary?
A.—Relays, which operate at a generator voltage corresponding to certain speeds.

1502-Q.—What results from operation of these relays?
A.—These relays in turn cause operation of other devices designed to provide braking force suitable for use at such speeds.

1503-Q.—What relays are supplied with current by the generator?
A.—The generator supplies current to the following relays; A directional relay, *1*—a directional repeater relay, *5*, and three speed governor relays, 2L, 2M and 2H.

1504-Q.—What is essential, in connection with the flow of current to the three speed governor relays?
A.—The flow of current from the generator to the three speed governor relays must be in the same direction regardless of direction of travel of vehicle.

1505-Q.—What device functions to provide current flow in the right direction?
A.—The directional relay, *1*.

1506-Q.—How is this relay used?
A.—The directional relay is used to detect the direction of travel of the vehicle and its contacts position themselves accordingly in order to provide current flow in the right direction through the remaining relays.

1507-Q.—How is the battery protected against possible draining during the time brakes are not applied?
A.—The *K-3* switch of the F.S.1864 relay valve located in the battery circuit, is open until a predetermined brake application pressure is developed.

1508-Q.—Describe the current flow as the vehicle begins to move.
A.—Current from the generator will flow through wire *21*, upper and lower coils of relay *1*, contact A-6-A8 of relay *5*, test jack *72-64* and wire *22* to the other side of the generator.

1509-Q.—With the current flowing in the direction described, how are the contacts of relay *1* affected?
A.—The contacts of relay *1* will be closed in the upper position.

1510-Q.—What current then results?
A.—With relay *1* so energized, current from the generator will also flow through wire *21*, contact *A3-A1* of directional relay *1*, resistor *7*, upper coil of relay *5*, contact *B2-B3* of relay *1*, through test jack *72-64* and wire *22* to the other side of the generator.

1511-Q.—Describe the current flow in case the vehicle movement is in the reverse of that described.
A.—Current from the generator will flow through wire *22*, test jack, *64-72*, contact *A8-A6* of relay *5*, upper and lower coils of relay *1* and wire *21* to the generator.

1512-Q.—With the current flow in the direction described, how are the contacts in relay *1* affected?
A.—They will be closed in their lower position.

1513-Q.—With the contacts in their lower position, how is the current flow?
A.—Current from the generator will flow through wire *22*, test jack *64-72*, contact *B3-B1* of directional relay *1*, resistor *7*, upper coil of relay *5*, contact *A2-A3* of relay *1* and wire *21* to the generator.

1514-Q.—How does the generator current also flow?
A.—The generator current also flows from wire *22*, test jack *64-72*, contact *B3-B1* of relay *1*, resistors *8L*, *8M* and *8H*, upper coils of relays *2L*, *2M* and *2H*, contact *A2-A3* of relay *1* and wire *21* to the other side of the generator.

1515-Q.—In this set-up, what does the directional relay 1 therefore establish?
A.—Generator current flow to the speed governor relays *2L*, *2M* and *2H* in the same direction regardless of direction of vehicle travel.

1516-Q.—Will the contacts of relay *1* remain in the position assumed during energization of the relay?
A.—Relay *1* is so constructed that its contacts will remain in the position assumed during energization of the relay even though the coil then becomes de-energized.

1517-Q.—How, then, can the position of the contacts of relay *1* be changed?
A.—Only by energizing the relay in a direction the reverse of the previous energization.

1518-Q.—What happens when the vehicle reaches a speed of approximately 8 m.p.h?
A.—The current flowing through the upper coil of relay *5* will be sufficient to operate this relay to the energized position.

1519-Q.—Which contact is affected?
A.—Contact *A6-A8* is opened.

ELECTRICAL SECTION

The Dayton drive takes power from a flat axle pulley by means of three V-belts as shown

Caboose Generator Drives

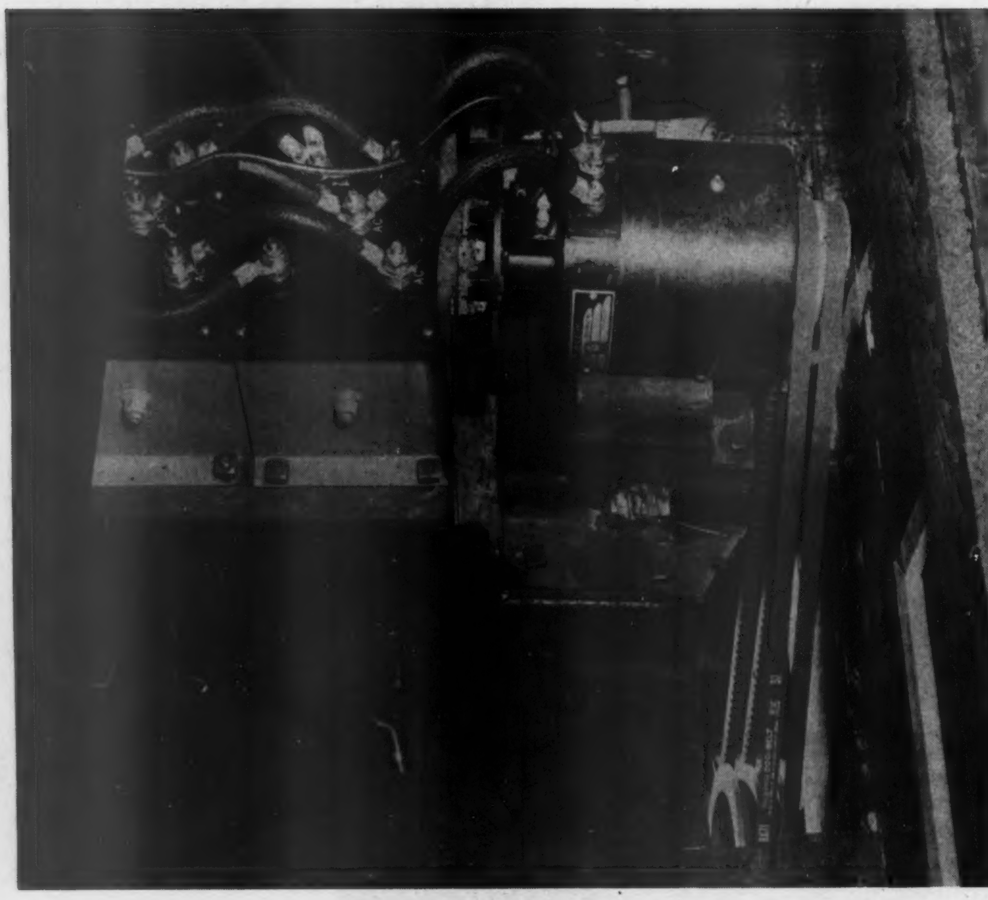
Present status of the double-reduction V-belt drive as combined with a variable-frequency generator to produce 14-volt d.c. power

THE most recently developed combination of Dayton endless belt drive and Leece-Neville a.c. generator for caboose power supply were described at a meeting of the Air Conditioning Club, held in Jacksonville, Fla., February 11, 1953. The drive is a double-reduction drive in which three endless V-belts are driven by a flat axle pulley. The pulley bears against the backs of the belts as shown in one of the illustrations. The spring at the left holds tension on the belts. The V-sides of the belts run over two roller-bearing idler pulleys and over a third triple V-pulley on an idler shaft. On the idler shaft there is also a two-groove pulley over which run two V-belts which drive the generator as shown in another illustration.

The generator delivers variable frequency, a.c. power to a dry-type rectifier which in turn produces 14-volt d.c. power. The generator voltage is controlled by the d.c. output voltage of the rectifier.

Characteristics of the drive were outlined by E. K. Lofton, of the Dayton Rubber Company, Dayton, Ohio. He said, in part, "We are asked sometimes why we do not use flat belts. The chief reasons why V-belts were used are because they offer higher load carrying capacities and because, of their very nature, they will tolerate some misalignment. A flat belt on a three-point drive requires perfect vertical and horizontal alignment. Our V-belt caboose drives meet satisfactorily the four major operating conditions. The use of endless V-belts offer maximum life and permits application without tools. The drive is able to withstand the high impact loads of freight service and the wide lateral movement of the axle during operation because all parts of the drive are fixed to the underframe of the caboose. Since the V-belts loop over the axle pulley on their backs, performance is not affected by lateral axle movement. It is possible to apply the drive any desired distance off from center line of the truck in order to avoid interference with brake rods or levers.

"In the application of this drive, the alignment of the



The Leece-Neville generator and rectifier and the upper two-belt part of the Dayton drive

faces of the pulley support brackets is an important item. This is where we experienced most of our original application troubles. It is not so much because good alignment is difficult to achieve, but mainly because this work is almost always done in freight shops where they are accustomed to handling only the roughest tolerances. Care should be taken in the shaping of the brackets, and drilling and tapping of the brackets should be done after shaping. Brackets must be made of strong metal due to the high strains encountered. Nothing lighter than ¾-in. plates should be used, and these should be strengthened with gussets where advisable. It has proved mutually beneficial for us to have a Dayton Rubber service engineer present at the time of a first application.

"The drive has been designed for easy and minimum maintenance. The bearing and grease capacities of the idler pulleys are several times normal needs. To lubricate the idlers once every 12 months is sufficient. We recommend Regal Starfak No. 2 (Texaco). The Dayton Cog V-belts in average service will give from 15 to 24 months life during which time one adjustment for V-belt tension will be required. If the spring length for proper tension has not been calibrated, then it is necessary to check tension by feel. The V-belts should not be fiddle-string tight. It should be possible to depress one strand ½-in. to ⅝-in. below the others with one finger without applying undue pressure. The satisfactory operating tension limits of a V-belt are by nature fairly wide. To apply a set of new V-belts is only a matter of about 15 minutes for either drive and no special tools are required. Only new matched sets of belts should be applied. One new V-belt should not operate with older ones. Old V-belts can be saved to be rematched into sets."

History of Caboose Drives

Mr. Lofton also presented a brief history of the development of caboose drives as follows:

"It was not until 1939 that major railroads made applications of generating power supply systems to cabooses or cabin cars. Actually there were some in service long before that time, but they had been devised and applied by the crews themselves. Going back to the middle 1920's, there were many installations of dry-cell batteries or just automobile batteries, some with 6-volt generators, driven by wind-mills or even some by hand-cranked flywheels. Every possible manner was used to put electric lights in cabooses. The first railroad installations, made in 1939, by the Great Northern, were of wind-driven type with a fan blade on the caboose roof. These were also 6-volt systems intended for lighting only. The wind-driven fan or propeller was capable of delivering sufficient horsepower but under very limited conditions. It required a 15- to 20-mile per hour differential between train speed and wind velocity as an operating minimum, and to avoid destruction of the equipment, it was necessary that the fan cut itself out when this differential reached 45 to 50 m.p.h. The next step involved installations of the same 6-volt generating equipment, using conventional flat axle-belt drives, and then small engine-generator sets were tried. After many trials, the Great Northern asked for assistance in the development of a drive capable of handling larger capacities, which would perform satisfactorily in freight train service. As the result of much study, trial and error, and quite a few uncomfortable caboose rides, an endless V-belt axle drive was produced which was very similar to the one shown in the illustrations.

"All of our early experiences dealt with caboose power supply for lighting only. An efficient low cost system was developed, but it was of comparatively low capacity, sufficient only for lighting purposes. Radio communication did not become a factor until late 1945. At present there are a total of 1,048 V-belt caboose drives in service on 37 major railroads. Generator capacities have been satisfactorily handled up to and including 4,000 watts at 32 volts."

Generator and Controls

The Leece-Neville Company's contribution to the caboose power system is described in a paper prepared by Harold J. Zuske and Robert G. Hill of that company. In presenting the paper, Mr. Zuske traced the history of the development of the present generators and controls. The Leece-Neville Company has, for 40 years, pioneered developments in the automobile generator and engine cranking motor field. This led to a three-phase alternator-rectifier system for heavy duty service, and during the war into a variety of aircraft applications.

In describing the generator and its components, Mr. Zuske said in part: "The rectified alternating current power system has for some time been in regular service on heavy duty, passenger car, truck, bus and aircraft applications. This equipment has been redesigned specifically for railroad installations. Its outstanding characteristics are totally-enclosed rugged construction, corrosion protection, heavy duty bearings, low-speed wide range performance, no commutating problem and reversible rotation. Units rated at 7 and 14 volts for currents of 75 and 100 amp. are currently in production. These ratings apply to systems using lead-acid type batteries. We have standardized on a 2 volts per cell system rating, 2⅓ volts per cell generator rating and 2½ volts per cell maximum rating. For example, this places the 3-cell battery in a 6-volt system with a generator rating of 7 volts, capable of 7.5 volts maximum. Edison nickel-iron or nickel-cadmium battery charging systems are being built per customer's specifications. The current values are established by the alternator design and the rectifier. Rectifier ratings are conservative. Our power units use 5-in. by 6-in. size cells with a convection rating of 12.5 amp. per plate at an ambient temperature of 95 deg. F. Thus, the forced air cooled ratings are 50, 75 or 100 amp., depending on the number of plates in parallel. This means a convection cooled system will use two power rectifiers in parallel for room temperature operating conditions or three in parallel if ambient temperatures up to 122 deg. F. are experienced. Standardization is practiced by using one alternator with several rectifiers for different ratings. The regulator is made to maintain the ratings selected. The control units use as many common parts as possible with differences being in coil, contact or circuit specifications.

"The rotor consists of two iron forgings. This design has been spun tested to 14,000 r.p.m. without mechanical failure. Wide bearings were selected for their extra grease capacity. The outer race is drilled to permit external greasing when desired. Cooling is accomplished by drawing in air over the pulley and belts, and exhausting it across the outside of the machine. The slip rings are housed in a chamber by themselves which isolates them from dust and dirt.

"The selenium power rectifiers are of the three-phase full-wave bridge design. The terminal board has ⅜-in. studs with ¼-in. studs for the control rectifier. The small control rectifier is mounted on the underside of the terminal board. This design has been tested under electrical load and mechanical vibration of 3/16-in. amplitude at 30 cycles per second, for 1,000 hours without failure. There are no heavy current-carrying brushes.

"The system has a very low reverse-flow through the rectifier. To prevent discharge of the battery, this flow is broken by a relay. When the alternator rotor starts turning, residual magnetism produces enough a.c. current, which is rectified by the control rectifier, to actuate the load relay. When the relay closes, current from the battery energizes the rotating field. When rotating of the alternator ceases, the relay opens. Thus, the contacts are closed before the current flows and are opened only after voltage falls. There is no arcing condition.

"The upper contacts of the double-contact regulator are closed at the start. As voltage rises, the upper contacts open, sending the field current through a resistor and reducing the output voltage of the alternator. As the voltage continues to rise, the lower contacts close. This momentarily grounds the current flowing to the rotating field, so that the voltage at high speed is still held constant.

"The opening and closing of the contacts takes place rapidly and the regulator armature vibrates against the upper or lower contacts, depending on the speed of the alternator and its load.

"There is a current limiter element which has a magnet coil in series with the load. If the current becomes greater than the setting, the contacts open to send the field current through a resistance. This reduces the output of the alternator and protects the electrical system.

"Machines in capacities up to 100 amp. are available for use with various Dayton drives with either 6 or 12-volt equipment. To illustrate a specific example—with a Dayton No. 3 drive and 36-in. car wheels, a machine will develop 14 volts no load at 10.3 m.p.h., 14 volts and 50 amp. at 14.6 m.p.h., and 14 volts and 75 amp. at 17 m.p.h. The maximum speed of the alternator occurs at approximately 86 m.p.h."

Parts for Alco-G.E. diesel-electric locomotives in production at General Electric's Locomotive and Car Equipment Department in Erie, Pa.

To date it has cleared up carbon grounds in five generators and one traction motor after all other methods had failed

The Elco machine has demonstrated its ability to clear up grounds due to carbon without dismantling the equipment, thus permitting the locomotive to continue in service until the next general repairs

Carbon Grounds Cleared in Place

Grounds due to carbon in the windings of diesel locomotive main generators and other electrical apparatus can be cleared up without dismantling the equipment by a machine that has been undergoing trial for the past year at the Chicago & North Western's 40th street shops in Chicago. Developed in his spare time, and patented by L. E. Legg, electrical engineer, C. & N. W., the machine apparently disintegrates carbon with damage to the equipment in clearing up the ground.

The primary purpose of the machine is to clear up carbon grounds in the main generator so that the locomotive can continue in service until the next general repairs. The machine will not clear up moisture grounds, nor will it repair damaged insulation.

The use of the machine to date has been restricted to clearing up grounds only after all other methods have failed. Thus, the machine has been the only alternative to keeping the locomotive out of service several days to perform the expensive job of removing and dismantling

the main generator. Though used only as a "last resort," the machine has succeeded in clearing the grounds over 75 per cent of the time, with several generators still in service nearly a year after the ground was cleared.

Termed the Elco Process, the use of the machine is simple. The affected piece of apparatus is isolated electrically from all other circuits. The Elco machine is then attached and operated by a qualified electrician. Disintegration of the carbon to clear up the ground requires from a few minutes to several hours.

Experiences To Date

The Elco machine has been tried on seven main generators and three traction motors. It cleared up the grounds on five of the seven generators which were caused by carbon. It did not clear up the grounds on the remaining two as these resulted from deteriorated insulation and heavy metallic grounding. Of the five generators on which the grounds were cleared, four are still in service. The fifth was removed for reasons other than generator failure.

The Elco process has also been tried three times on traction motors. One cleared May 27, 1952, is still in service. It could not clear the grounds in the other two. One of these was still under warranty, and the cause of the ground was not determined. The ground on the second motor was found to be due to an insulation failure on the leads rather than carbon buildup within the traction motor.

The following examples give details of the ground conditions typical of those occurring on all roads which were cleared up on the North Western by the Elco Process during 1952:

March 18—Freight unit 4077A was tied up at Clinton with a zero ground in the armature of the main generator, which was new October, 1949. The locomotive was sent dead to Chicago and the ground cleared up to infinity the day of arrival. The generator is still in service.

March 19—Passenger unit 5013B—The No. 2 generator, which was new in 1947, had a zero ground. It was cleared up to a megger reading of infinity by the Elco process. The generator was removed three months later while the engine was being changed out. The changeout was not due to generator breakdown. It was done simply because the roof was the locomotive and it was suspected that due to previous grounding the insulation had probably deteriorated.

April 24—Freight unit 4066B, which was new in December 1947, had a zero generator ground at Council Bluffs, was given up and brought dead to Chicago. The ground was cleared up the day the locomotive arrived, and the generator is still in service.

May 26—Passenger unit 5013A—The No. 1 generator, new in 1947, was cleared from zero to 5 megohms, and is still in service.

July 21—Freight unit 4054A—The main generator, overhauled June 1950, was cleared up from a 50,000-ohm megger reading. It is still in service.

Sept. 27—Freight unit 4083A—The main generator armature was grounded so badly that it was impossible to motor it to start the engine without blowing the fuses. The ground was cleared up sufficiently by the Elco Process to permit the generator to start the engine, but not enough to allow the generator to be placed in service. Upon dismantling the generator it was found to have a hole in the armature and the lamination burned. The machine was therefore successful in clearing up that portion of the ground due to the carbon, but could not of course remedy the main cause of the ground as this was beyond its scope.

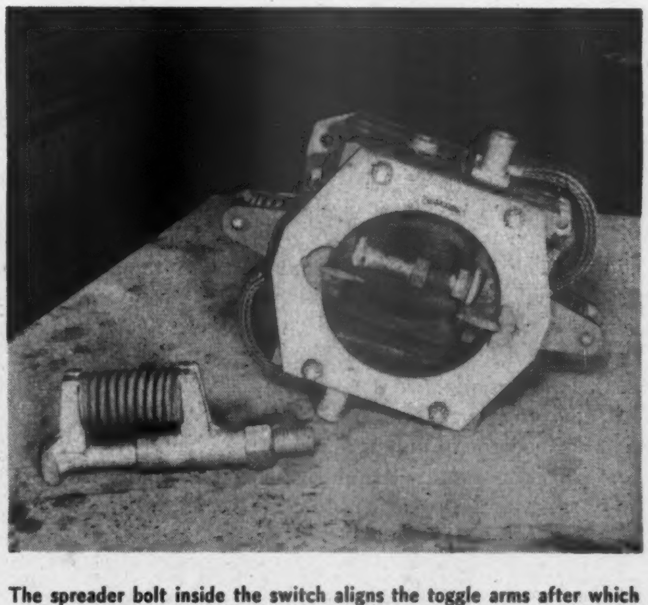
Another case where the ground could not be cleared up by the Elco Process was on passenger unit 5004A, another ground caused by a situation beyond the scope of the machine. This unit had a zero megger reading caused by a metallic ground, which is of course physically impossible to clear up by disintegrating the carbon. The ground was cleared by changing out an interpole.

Pole-Changer Overhaul

Shown in the illustration are a spring compression tool and a jack developed in the Portland, Oregon, shops of the Union Pacific, to facilitate the overhaul of General Electric axle generator pole changer switches.

In overhauling the switches, it is necessary to remove the toggle spring. To do this, it is first necessary to align the two toggle arms of the switch as shown at the right in the illustration. This is done by means of the spreader jack shown inside the switch. It is made of a 5/8-in. bolt, and is placed inside and extended with a wrench as shown.

The spring may then be compressed with the tool shown at the left. It is made of a 7/8-in. x 8-in. bolt, and a piece of 1-in. x 3½-in. extra heavy steel pipe. On the head of the bolt and the side of the pipe are welded two fork-shaped brackets, sized to fit over the toggle arms of the switch and notched to fit the spring caps. Taking up on the bolt, compresses the spring which may then be removed as shown. The switch is then free for cleaning, repairs or replacement of worn parts.



The spreader bolt inside the switch aligns the toggle arms after which the spring is compressed and removed with the tool shown at the left

DIESEL-ELECTRICS—How to Keep 'Em Rolling

16 The Diesel Engine Governor

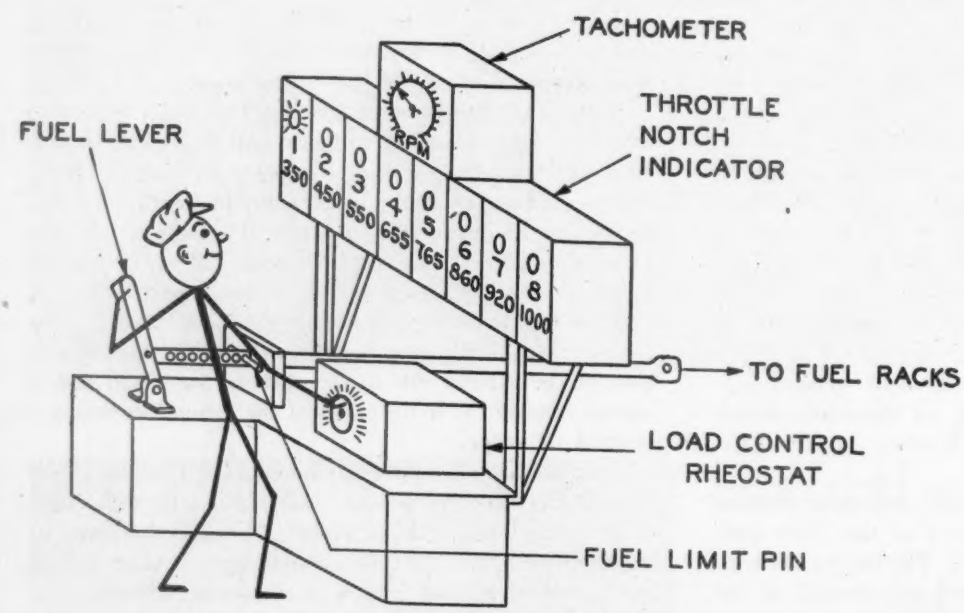


Fig. 1—One way to govern a diesel engine

The diesel locomotive governor does five things for the operator which would be very difficult to do by hand

We all know something of the evolution of the automobile engine. Anyone who could keep one of the early "horseless carriages" running was something of a genius. Engine life and miles per gallon didn't mean much then. Now everything is changed. Keeping a modern auto engine running is mere child's play, but car owners are very interested in engine life and economy.

The same thing has happened to the locomotive diesel engine. The "oil electric" locomotives of the 30's were pretty crude by today's standards, but they pioneered a new era in railroading. Modern diesels are easy to keep running and to operate. In fact, almost everything about them is automatic.

One of the parts that does a lot to help make the diesel-electric locomotive automatic is the engine governor. Its first job is to control the engine speed. Some governors go farther and protect the engine from overloads that would damage it. They do this by limiting the amount of fuel that can be fed to the engine.

Perhaps you remember the old "flyball" governor. It made use of a pair of spinning weights to measure engine speed. These were connected to the fuel control by rods and levers. Though this governor was entirely mechanical, it did a good job of controlling the early low-speed engines.

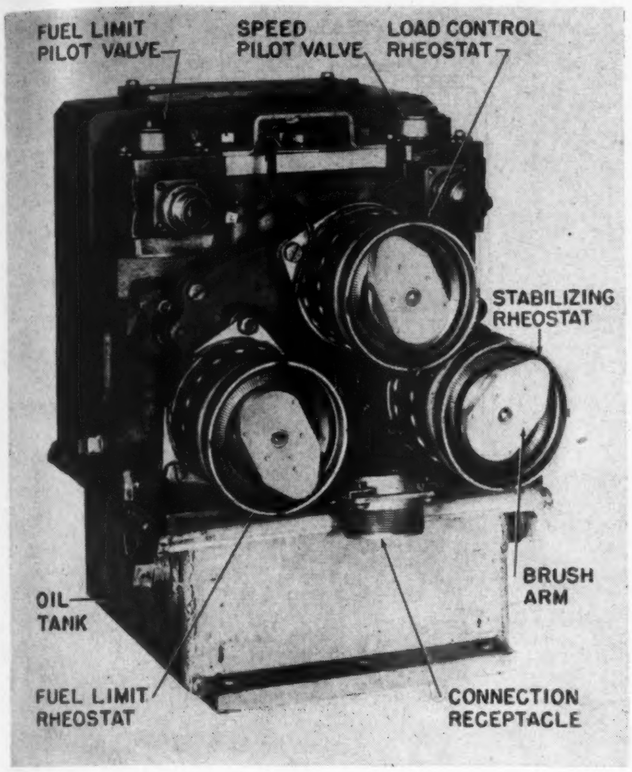
Today's high-speed diesel engine has a much tougher job to do than its older brother. It needs to be "teamed up" with a high-speed governor. A number of these have been developed. They are not as simple as the old "flyball"; but with a little study they are almost as easy to understand. Most of them have mechanical, electric and hydraulic parts.

A good way to get an idea of what the governor does is to imagine that you are going to do the job yourself. You would have five different things to attend to. In Fig. 1 you see what you would need to do it.

Speed Signal

Since you are going to control diesel engine speed, you will need a tachometer. This is like the speedometer on your car, except that instead of miles per hour, it reads engine revolutions per minute (r.p.m.).

* This is the sixteenth of a series of articles on maintenance of diesel-electric equipment. This article is written by B. L. Judy, M. W. Bells and E. B. Heft, all of the Locomotive and Car Equipment Department, General Electric Company, Erie, Pa.



notch. Part of your job will be to move the pin from hole to hole as the throttle is moved. When controlling speed, you can move the fuel lever until the pin is up against the stop. Then you won't be able to give the engine any more fuel—you've reached the limit for that notch.

Load Control

Since there is a limit to how much fuel you can feed the engine, you won't always be able to keep its speed up. Although you may have the pin against the stop, the speed will still be low. This means that the engine has more load than it can handle and is beginning to stall. If you want to get it back up to speed, you must reduce the load.

The traction generator is the load for the diesel engine. You can decrease the load by decreasing the generator field strength. To do this, you will need a rheostat connected to the generator field control circuit. Then you will be able to increase or decrease the engine load by turning the rheostat knob. Thus, if the speed is still low after you have given the engine all the fuel the pin allows, you can turn the rheostat knob to reduce the load and bring the engine up to speed. Actually, this is how engine speed is held most of the time when the locomotive is on the road. It lets you get full horsepower from the engine at all times.

Fig. 2 (above)—Diesel engine governor used on Alco-G.E. locomotives.

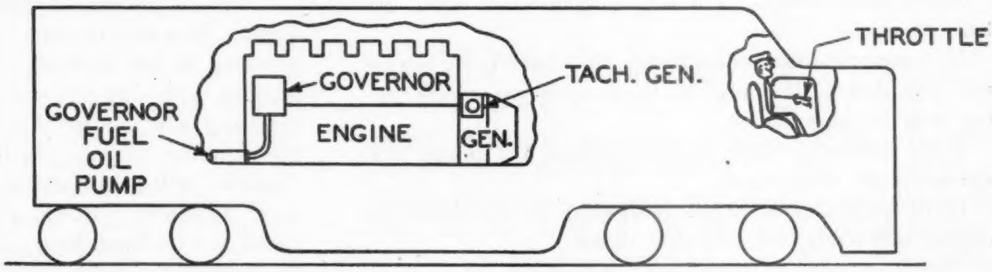


Fig. 3 (right)—Governor and Associated speed control equipment.

Speed Control

The amount of fuel fed to the engine controls its speed. Suppose you have a hand-operated lever connected to the fuel racks on the engine. By moving this lever you can control the amount of fuel fed to the engine. If the engine slows down, you will have to increase the fuel. If it speeds up, you will have to decrease thee fuel. So, by watching the tachometer and moving the lever you can hold engine speed.

Throttle Control

Most diesel-electric locomotives have eight throttle notches. The engineer controls his locomotive speed by moving the throttle from notch to notch. For each notch, there is a definite engine speed. If you are going to control the engine you will have to know where the engineer has the throttle. To tell you this, suppose you have a row of lights wired up to the throttle. Under each light there is a notch number and the corresponding engine speed. When a light is lit, it will show you which notch the throttle is in. Then you will have to hold the speed for that notch.

To keep from overloading the engine, you must limit the fuel for each throttle notch. This can be done with a pin and eight holes (Fig. 1). There is a hole for each

If you can do these five things all at once, and keep doing them hour after hour, you will be a pretty good "governor". The job will keep you as busy as a one-armed paperhanger! Also with this set-up you could only control a single engine. A three-unit locomotive there would have to have a man for every engine on the job all the time. This sure would be pulling a train the hard way!

Let's look at one type of governor that actually does these jobs for us (Fig. 2). It is used on Alco-G. E. locomotives. Figure 3 shows the governor and all that goes with it to control the engine speed. Now we will see how this system handles the engine.

Speed Signal

The tachometer generator on the engine measures speed. It puts out voltage instead of moving a needle as the tachometer did. The higher the engine speed, the higher this voltage.

The tack generator, as it is usually called, could be a small d.c. machine; but then there would be brushes and a commutator to care for. By using an a.c. generator, we get away from all this. Then we use rectifiers to change

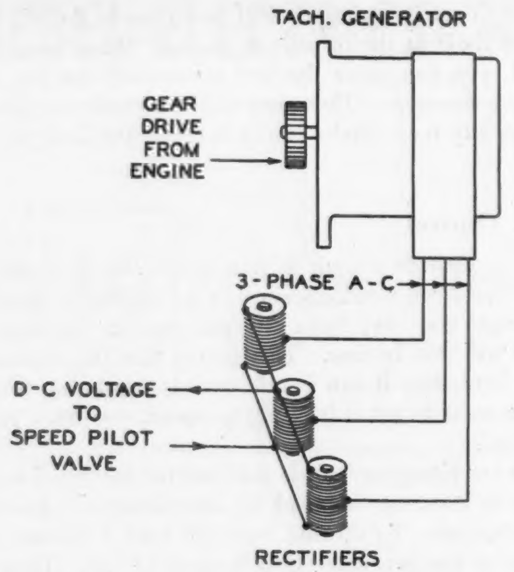


Fig. 4—How the tachometer generator furnishes direct current to the governor

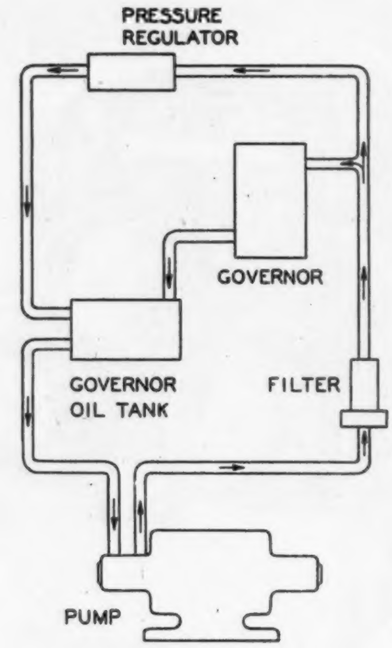


Fig. 5—Governor oil system

the a.c. into d.c. (Fig. 4). The three-phase a.c. makes a more steady d.c. voltage than if single-phase a.c. were used. It's something like using a three-cylinder engine instead of a "one lunger."

There are a couple of things to remember about the tach generator.

If its electric connections loosen or come off, the engine will shut down. If one of its leads opens up, speed control will be very rough.

If the generator drive shaft is broken, the engine will automatically shut down.

If the generator armature is slipping on the shaft, the engine will overspeed and shut down.

The Muscle

When you played "governor", you moved the engine fuel racks by muscle power. The locomotive governor uses high-pressure oil for this job. This is supplied by the governor oil pump located on the deck directly under the governor. As shown in Fig. 5, it takes oil from the governor oil tank, pumps it through a filter and then to a pressure regulator. The filter cleans the oil before it is delivered to the governor. The regulator keeps the oil pressure between 130 and 140 lb.

If the oil pressure is low, the governor action will be weak. It won't be able to hold the speed steady. If pressure is low enough, it won't work at all. A filter plugged with dirt will cut down the oil flow. Then the governor will not be able to move fast enough to keep up with the engine. If the pressure is too high, the "muscle" will be too strong and the governor may pound itself to pieces. If the governor is not doing its job, check the oil filter first. Next, check the adjustment of the pressure regulator.

The Arm

Muscle is no good unless we have an arm to put it to work. In this case, the "arm" is a piston called the "slave piston" (Fig. 6). It is free to float in its cylinder and is removed by oil pressure. This piston, in turn, is linked to the fuel racks and moves them. Oil pressure acts on either the top or bottom to move the piston. One

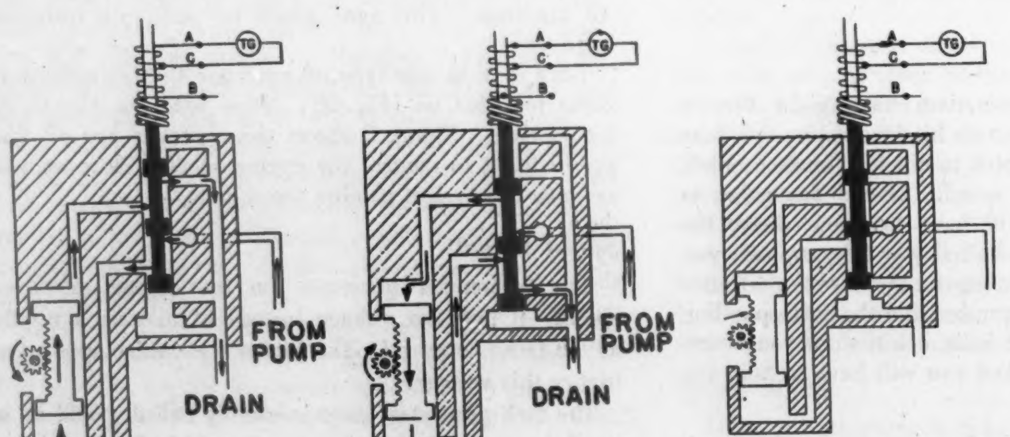


Fig. 6—How the pilot valve controls the movement of the slave piston

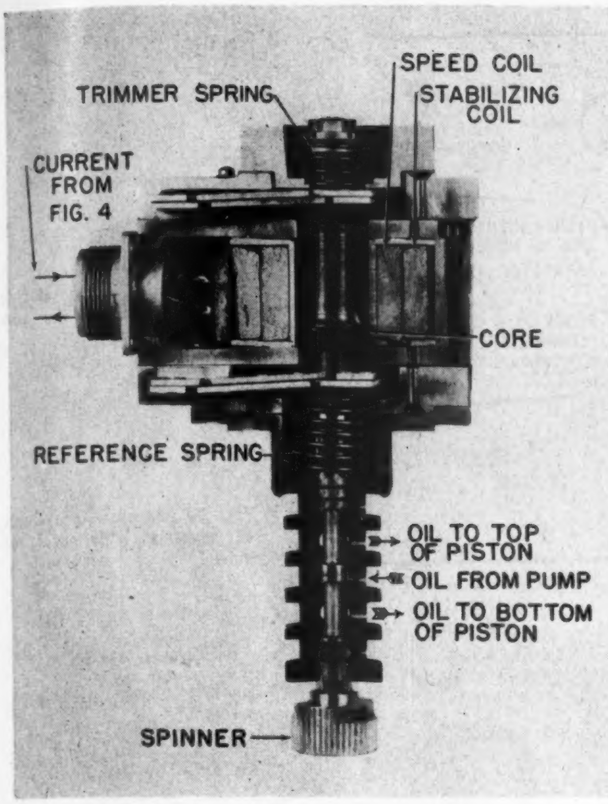


Fig. 7—Speed solenoid cross section

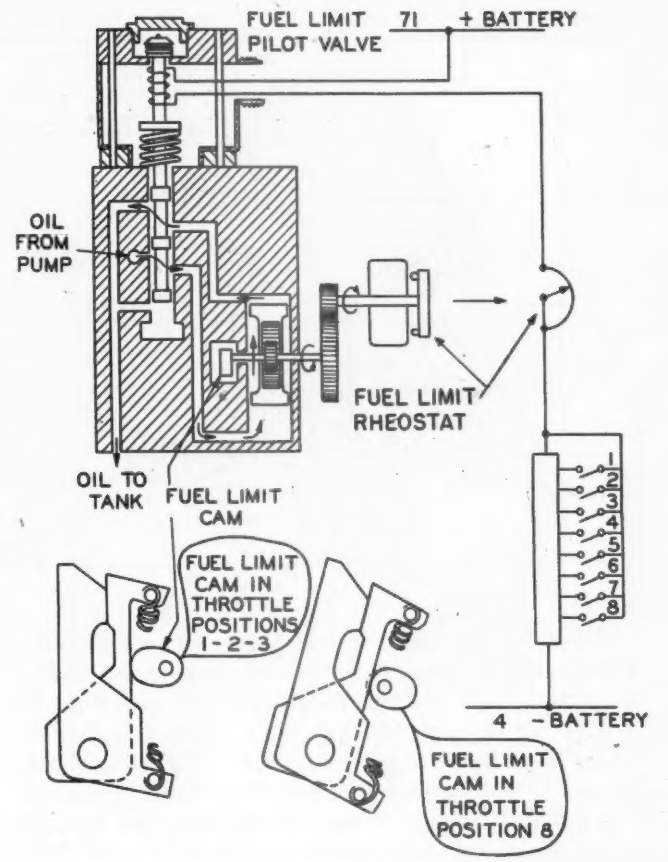


Fig. 8—How the fuel limit operates

side of the piston has gear teeth. These mesh with a gear to form a "rack and pinion." The pinion is keyed on a shaft that moves the fuel linkages.

If dirty oil, or the wrong kind of oil is used in the governor, the slave piston will wear rapidly—just as the pistons of your car engine would. A worn slave piston will slow the governor down. Then it will do a poor job of holding speed. So whenever you add oil to the governor be sure that it is the right kind and that it is clean. This will prevent a lot of grief. Clean the covers before you take them off. Dirt on them will drop into the oil tank.

The Eye

A speed pilot valve controls the flow of oil to the slave piston. This is the "eye" of the governor. It "watches" the tach generator voltage and tells the governor whether to increase or decrease fuel. The pilot valve is just an oil valve that is operated by electricity. In Fig. 7, you see a pilot valve that was pulled out of a governor and cut in half. The electrical part is at the top and the oil part at the bottom.

The core in the coil is free to move. Current from the tach generator flows through the coil and magnetizes the core. This makes it try to pull down into the coil. The more current flowing, the stronger the pull. Two springs push up on the core and buck this downward pull. You might say these springs "weigh" the magnetic pull, just as a fish scale weighs a fish.

The plunger of the oil valve is connected to the bottom of the core by a universal joint. As the core moves up and down, it moves the plunger with it. This opens and closes ports which feed oil from the governor oil pump to the slave piston. A small stream of oil squirts against the spinner at the bottom of the plunger. This turns the plunger and keeps it from sticking.

Normally, you will have little trouble with the pilot valve, but one thing you should guard against is dirty oil. It is the worst enemy of the pilot valve. It can gum up the plunger and make it stick. Chunks of dirt or chips can lodge in the ports and hang it up also. Dirty oil wears the plunger and makes the valve leak. Any of these will cause the engine speed to go up and down continually. This is called "hunting."

Fiddling with the pilot valve trimmer spring fouls up all of the speed adjustments. This spring should never be adjusted except when the valve has been overhauled. The pilot valve coil, like any coil, may develop an open or a short circuit. If this happens, the engine will shut down.

When the pilot valve is controlling speed, the plunger will be in one of the three positions (Fig. 6), depending on the engine speed.

(1) When the engine speed is low, the tach generator voltage will be low and the current through the pilot valve coil will be low. This makes the downward pull on the core low, and the springs will push it and the plunger up. Oil from the pump will flow to the bottom of the slave piston (Fig. 6 a), and force it up. This will turn the pinion and move the racks to increase fuel and speed the engine up.

(2) When the engine speed is high, the tach generator voltage will be high and the current through the pilot valve coil will be high. This will pull the core and the plunger down. Oil will flow to the top of the slave piston (Fig. 6 b), and force it down. This will move the racks to decrease fuel and slow the engine down.

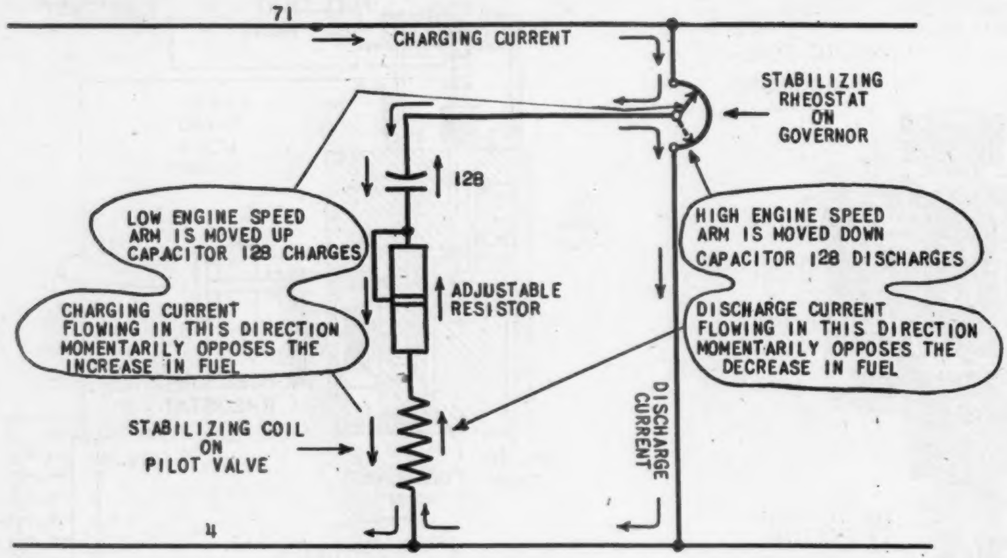
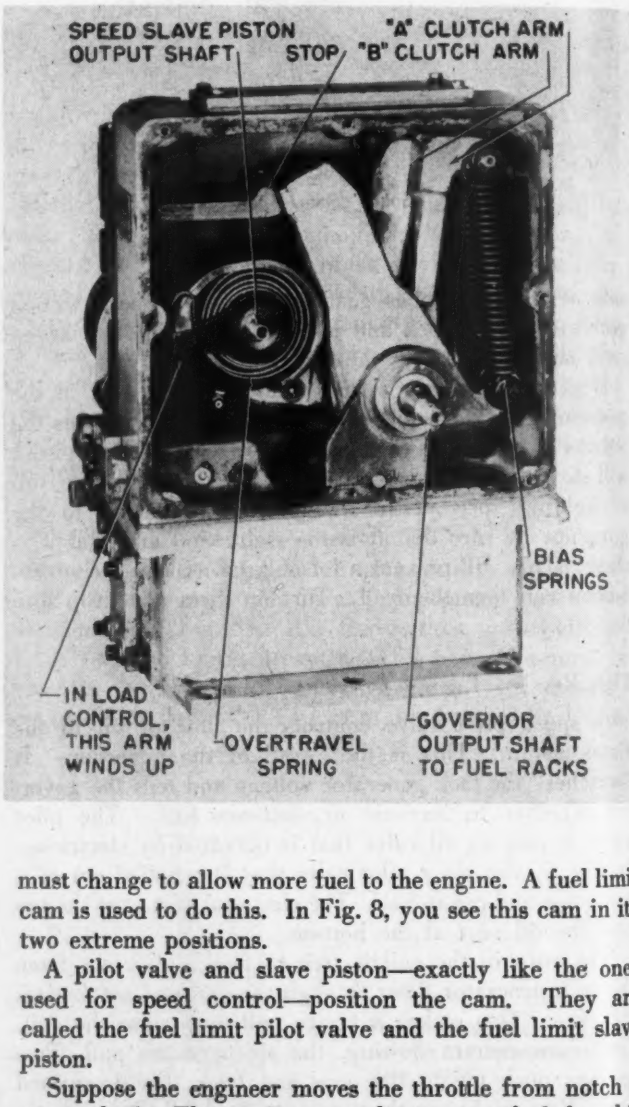


Fig. 9 (left)—An electric dashpot stabilizes the governor.

Fig. 10 (below)—Back view of governor with cover removed.



(3) When the engine speed is right, the tach generator voltage will be right. Then just enough current will flow through the coil to center the plunger and cut off the oil flow to the slave piston (Fig. 6 c). This is called the balanced position for the pilot valve. The valve should balance with a current of about 0.475 amp. in the coil. You get this balance current by adjusting the trimmer spring at the top of the valve.

Now we must have some way to let the engineer set the eight engine speeds for the eight throttle notches. This will replace the lights you used when you were the "governor." To do this we have a resistance connected in the tach generator circuit. It can be cut into or out of the circuit in eight steps by relays, operated through train wires from the throttle.

As the engineer notches out on the throttle, the relays cut resistance into the speed pilot valve coil circuit. This reduces current through the coil and causes the governor to increase fuel to the engine. As the engine speeds up the tach generator will put out higher voltage. When the voltage gets high enough to send 0.475 amp. (the balancing current), through the pilot valve coil, the valve will close. This cuts off oil flow from the slave piston and holds the engine speed at the new value.

When the engineer cuts the throttle, the opposite happens. Resistance is cut out of the pilot valve coil circuit. The current increases and the governor cuts the engine fuel. As the engine slows down the tach generator, voltage comes down until it is low enough to balance the pilot valve again. The valve will then cut off oil flow to the slave piston and hold the engine speed at the new value. Regardless of what happens, the pilot valve always tries to reach the balanced current position.

Fuel Limit

A diesel engine likes fuel just as a child likes candy—the more you tell your child when he has had enough candy, so the governor tells the engine when it has had enough fuel. When you were "governing" the engine, you limited the fuel in each notch by a pin. Now let's see how such a limit is built into the governor.

All that we need on the governor is a stop to limit the travel of the linkage that operates the fuel racks. As the throttle is notched out, the position of this stop must change to allow more fuel to the engine. A fuel limit cam is used to do this. In Fig. 8, you see this cam in its two extreme positions.

A pilot valve and slave piston—exactly like the ones used for speed control—position the cam. They are called the fuel limit pilot valve and the fuel limit slave piston.

Suppose the engineer moves the throttle from notch 4 to notch 5. The engine must have more fuel for this higher speed, so the fuel limit must be raised. Moving the throttle will operate relays which close contact 5 (Fig. 8). This cuts resistance out of the fuel limit coil circuit. More current will then flow through the coil. It will pull the pilot valve plunger down, and oil will flow to the top of the slave piston. As the piston moves down,

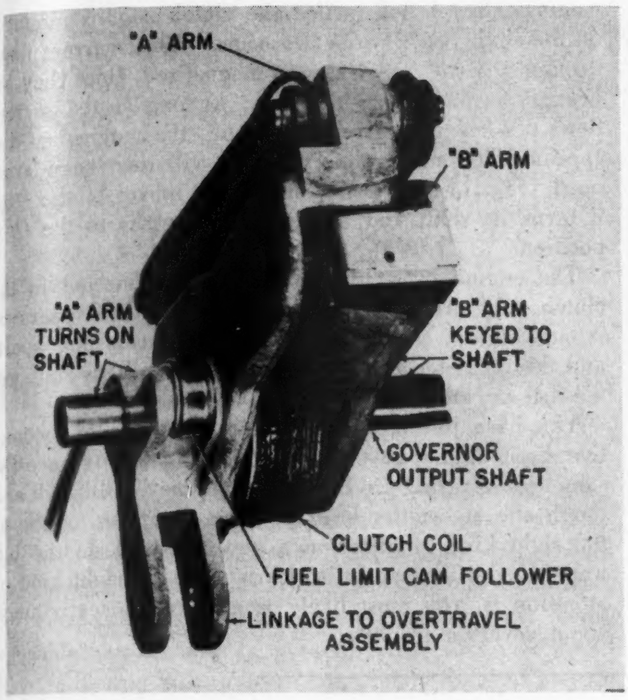


Fig. 11a—Clutch arms together. Current flowing through the clutch coil causes them to hold together like magnets.

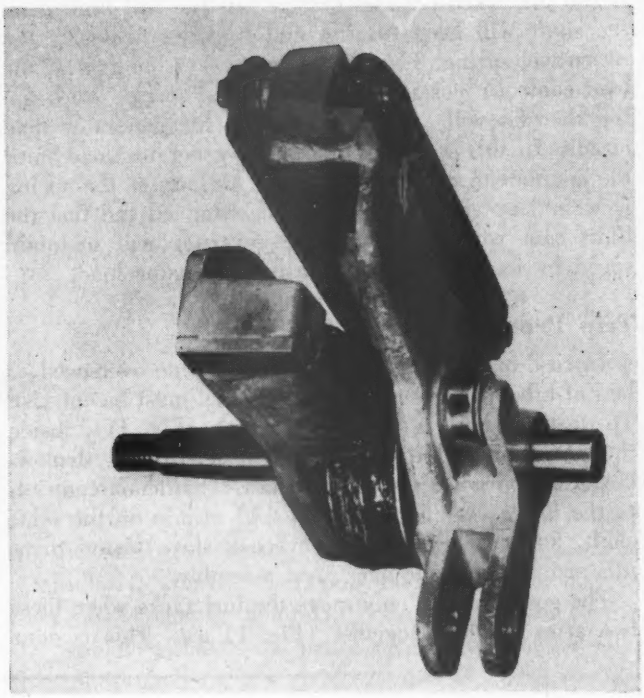


Fig. 11b—Clutch arms apart. No current in clutch coil. Bias springs snap them apart.

it will turn the pinion and shaft. A gear on one end of the shaft turns the fuel limit rheostat in a direction to cut resistance back into the pilot valve coil circuit. The piston will keep moving until sufficient resistance has been cut back to restore the current to about 0.475 amp. Then the plunger cuts off the oil supply and holds the slave piston fixed.

The fuel limit cam is on the other end of the same shaft, so it will be turned at the same time. When the piston stops, the cam will be at a new position. This will be the fuel limit setting for the new notch (number 5 in this case).

When the throttle is cut, the same action takes place in the reverse order.

Engine Hunting

If you were acting as "governor" for the diesel engine, you would have to work the fuel lever most of the time. That is because engine speed is always trying to go above or below the speed you are trying to hold,—in other words, the engine keeps "hunting". To correct this, you would be constantly increasing or decreasing fuel.

The automatic governor would have the same trouble unless something were done about it. An "electric dashpot" is added to the speed pilot to prevent hunting. A stabilizing coil, (Fig. 7), wound on the same spool as the speed coil, does this job. It opposes whatever the speed coil tries to do. You might call it the "cantankerous wife" of the speed coil. If Mr. Speed Coil tried to speed the engine up, Mrs. Stabilizing Coil tries to slow it down. If Mr. Speed Coil tries to slow the engine down, Mrs. Stabilizing Coil tries to speed it up. The stabilizing coil is not nearly as strong as the speed coil. So it never wins the argument, but just makes the speed coil go easy on the fuel changes.

In Fig. 9, you see how this combination works. The stabilizing rheostat is mounted on the governor. The rheostat arm is driven off the same governor shaft as the fuel racks. So every time the racks are moved, the rheostat arm moves too.

Battery current flows from the *71* wire through the stabilizing coil, (Fig. 9). When the engine speed is low, the speed coil pull is weak. This causes the governor to move the fuel racks to increase fuel. The same movement turns the stabilizing rheostat arm and decreases the resistance in the stabilizing coil circuit. Current flows down through the stabilizing coil for an instant until the capacitor *128* is charged. This adds to the weak speed coil pull and makes the pilot valve go easy on the fuel increase. So the engine speed is kept from overshooting.

When the engine speed is high, the speed coil pull is strong. This causes the governor to move the fuel racks to decrease fuel. As the racks move, the stabilizing rheostat arm is turned to increase resistance in the stabilizing coil circuit. This discharges the capacitor *128*, and current flows up through the stabilizing coil. This "shot" of current kills part of the speed coil pull. This keeps the fuel from being reduced too far and the engine speed from going too low. Thus pilot valve operation, and engine speed, are kept steady by the charge and discharge of the capacitor through the stabilizing coil.

A resistor is used to adjust the stabilizing circuit. Adjusting this resistor has the same effect on the governor as changing the adjusting screw has on a dashpot.

Load Control

When you acted as "governor" for the engine, you used a rheostat to reduce the generator load. The actual governor does the same thing.

There is a spring link inside the governor (Fig. 10), called the overtravel spring. As you can see, it looks like a clock spring. When the engine speed can be held without hitting the fuel limit cam, this whole spring assembly turns as a solid part of the shaft. But suppose the speed

is still low when the fuel linkage hits the fuel limit cam, the shaft will keep turning and begin to wind up the overtravel spring. The shaft is geared to the arm of the load control rheostat. As the overtravel spring winds up, the rheostat will cut resistance into the generator field circuit. In this way, it reduces the generator load until the engine can come up to speed. As long as the spring is wound up the engine will be getting all the fuel the limit cam will allow, and the governor will maintain speed by increasing or decreasing generator load.

Trip Protection

In case of an emergency, such as engine overspeed or loss of lube oil pressure, the engine fuel must be cut fast. To do this, there is an electric clutch (Fig. 11), inside the governor rack linkage. The outer, or "*B*" arm, is keyed to the governor output shaft. This shaft connects to the fuel racks. The inner, or "*A*" arm is on the same shaft, but not keyed. The governor slave piston turns this arm through the overtravel assembly.

The governor can only move the fuel racks when these two arms are held together (Fig. 11 a). This is done magnetically. A coil, called the clutch coil, is mounted on the shaft between the two arms. When current flows through the coil, the arms are magnetized. Once they are brought together, they will hold as long as the current flows. When the current is cut off, the magnetism disappears. The strong bias springs will then snap arms open (Fig. 11 b). As the outer arm moves to the stop, it turns its shaft and moves the fuel racks to the *OFF* position.

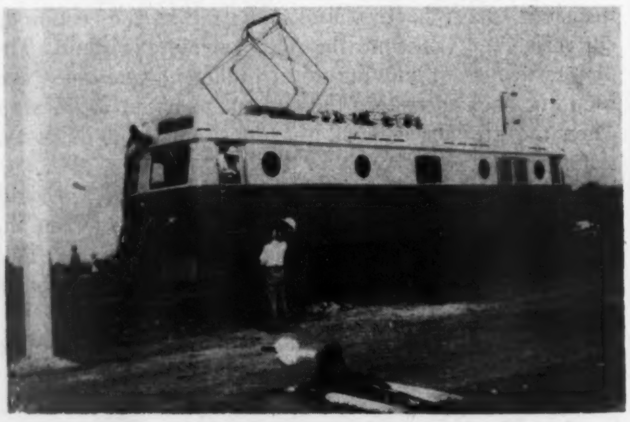
The engine protective switches are connected in the clutch coil circuit. When any one of them operates, it cuts off the clutch coil current, the arms pull apart, and the racks move to the *OFF* position. This shuts off the fuel and stops the engine.

You have just seen what makes one type of locomotive diesel engine governor tick. All governors have the same job—setting and holding engine speed. It's a tough one, no matter how it's done, but with a little of the right kind of attention a governor will do the job well. If you are careful to learn what the right kind of attention is, you most likely won't have to learn much about governor troubles.

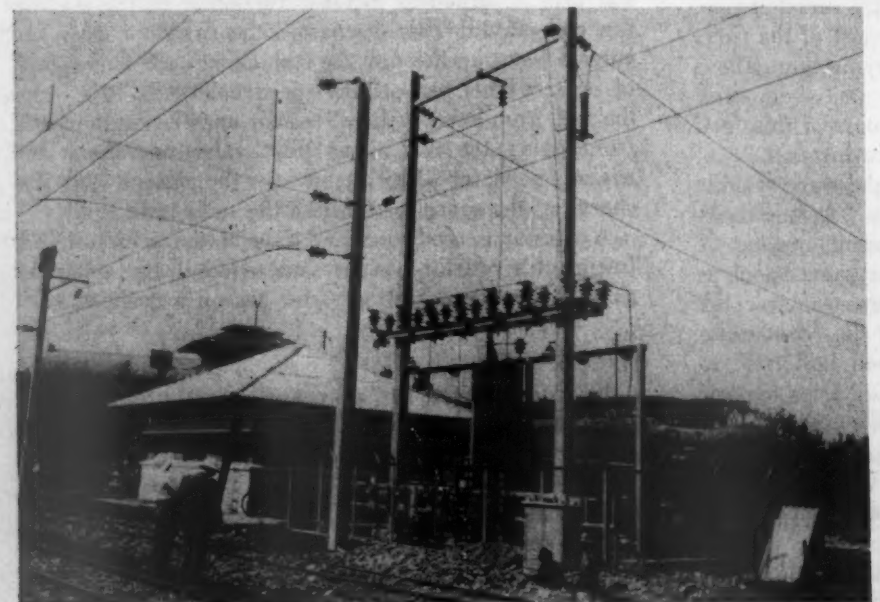
Central Africa's First Electrification

A 105-kilometer (approximately 65-mile) stretch of electrified railroad, said to be the first in Central Africa, recently was placed in operation on the Chemin de Fer du Bas Congo au Katanga, between Jadotville and Tenke in the Belgian Congo, according to Foreign Commerce Weekly.

Although of great importance economically, perhaps the most significant phase of the electrification is technical. Instead of using conventional 3-phase current at 1,500 or 2,000 volts, a single-phase, 22,000-volt, 50-cycle system is used. This method is used also on a 78-kilometer stretch in France. It is estimated the new African system saved 40 to 45 per cent in installation costs, due largely to the smaller amounts of copper needed in trolley and feeder lines. Also, the 22,000-volt installation permits greater distances between substations.



(Above) One of the locomotives for the Bas Congo au Katanga Railway.



(At left) The 22,000-volt, 50-cycle substation. This substation is not typical, being rather more complex than others.

EDITORIALS

Three Dimensions Are Better Than Two

It is a rather universally accepted principle that a person can learn things easier and quicker by bringing into play several of the five senses than when only one is used. This becomes obvious if you try to imagine how many times as simple an operation as tying a square knot would have to be repeated to learn to do it yourself by just seeing someone else tie one. It is equally true that you would have to be told how to do this job many times to be able to do it yourself if you had never seen the knot tied.

But how simple the task of learning becomes if one can see the knot tied while at the same time he can listen to an explanation of how it is done. One or two such demonstrations would teach most anyone how to tie the knot.

Now if this is true—and most people are willing to accept as true the contention that bringing more senses into play increases ability to learn—is it not also likely to be true that more intensive utilization of any one sense will likewise increase the ability to learn? A good example of this would be the use of models instead of, or in addition to, pictures or blueprints to show how something functions or is constructed. The use of three dimensions utilizes the sense of sight more intensively than the use of two dimensions, and hence should further aid the learning process.

Similarly, where a study job has to be done, the use of a model can be helpful in visualizing more clearly the problem at hand, and hence arriving at a better solution. Shop planning is a good example of where a model can be helpful. Scale models of floor plans and equipment are being used to an increasing extent by industry generally in planning new shops or revisions to existing shops.

There has been little interest in employing models for railroad shop planning—in fact only one that we know of. Perhaps the railroads are overlooking a good bet. The single instance where a railroad did employ a model to plan a shop has been a highly successful venture. The road considers that the time and money spent to make the model will be repaid many times over by the improvement they attained over the best they could have done by laying it out on paper alone.

Locomotive Accidents and Defects

Accidents and casualties resulting from failure of locomotives and their appurtenances have been declining steadily for several years. In the annual report of the I.C.C. Bureau of Locomotive Inspection just issued, reviewed elsewhere in this issue, those attributable to locomotives other than steam are shown to have increased from 54 in 1951 to 74 in 1952, but those caused by steam locomotives decreased from 167 to 122. Over all, therefore, there was a decline in locomotive accidents from 221 to 196. Likewise, fatalities declined from 16 to 4 and persons injured from 299 to 203.

This result is not due entirely to the influence of the increasing proportion of diesel locomotive units in service, although this is undoubtedly a factor of appreciable weight. The number of accidents per 1,000 steam locomotives for which reports were filed with the Bureau is also declining steadily. From 9.1 in 1947 it had dropped to 6.3 in 1951 and, again, to 5.95 in 1952. There has also been a decline in the number of casualties resulting from accidents caused by steam locomotive failures. This is attributable largely to the marked downward trend in the number of boiler explosions during the past five years.

One notable aspect of the shift from steam to diesel locomotives is the frequency with which inspections are being made. Each steam locomotive for which reports were filed is inspected an average of about 2.4 to 2.2 times per year. Each locomotive unit other than steam for which reports are filed was inspected about 2.75 times in 1951 and almost 2.9 times in 1952. The number of defects per locomotive other than steam inspected has increased slightly, but was still less than one defect per inspection in 1952. Steam locomotive defects averaged 1.2 per locomotive inspected during 1952.

In 65,263 inspections of individual locomotive units other than steam, which for the most part means diesel

power, the federal inspectors found 6,087 defects, or 9.3 per cent, and ordered 135 units out of service in the 12-month period ended June 30, 1952. This may be compared with 13,115 inspections and 19 units found unfit for service in 1947. The steady increase in both of these figures each year since 1947 is chargeable, of course, to the great many diesels constantly being placed in service.

An interesting observation with respect to the frequency of defects is that it is not always safe, statistically, to deal with averages. Yet, using the steam locomotive as a basis it is obvious that in any given category of defect the frequency of occurrence bears a relationship to the number of locomotives inspected. In 1947, the largest items of defects on steam locomotives were brake equipment; crossheads, guides, pistons and rods; injectors and springs and rigging. In that year 11.8 per cent of the defects were in these groups and in 1952 15.5 per cent. This consistency runs through the list.

The most prolific type of defect on this kind of motive power shown in the 1952 report related to internal-combustion engine parts and appurtenances, of which there were 4,768. Next was trouble with fuel systems in which 1,751 defects were reported. Third in number was 1,694 defects found in cab floors, aprons and deck plates, thus emphasizing the necessity of keeping these parts not only in good condition mechanically, but free from obstructions of all kind; and from oil and dirt which introduces fire and slipping hazards.

In the matter of brake equipment, sanders, cab windows, etc., there appears to be no reason why there should be much difference between diesel and steam locomotives. The penalty for neglect of such details on either type of power is to increase the number of reportable defects and, in certain categories of defective conditions, to cause the locomotives to be ordered out of service.

All classes of electrical defects on locomotives other than steam amounted to 1,218, of which motors and generators accounted for 674. Experienced railroad maintainers of electric locomotives are, in general, well versed in federal inspection requirements for this type of power, but even the names of electrical are still more or less a mystery to some individuals in mechanical forces now confronted with the problem of maintaining diesel-electric locomotives. These men need training and they need it fast in all safety features associated with electric power transmission in diesel locomotives.

The increasing safety of locomotive service is a welcome trend and one which may be expected to continue as the proportion of service rendered by diesel-electric units increases. There is little difference in the number of casualties per accident on steam locomotives and those other than steam, but the number of accidents per 1,000 locomotives in service is more than 40 per cent less in the case of locomotives other than steam than in the case of steam locomotives. On a mileage basis, the difference in favor of locomotives other than steam would be considerably greater.

NEW BOOKS

CONTROL OF ELECTRIC MOTORS. *By Paisley B. Harwood. Third Edition. Published by John Wiley & Sons, Inc., 440 Fourth avenue, New York. 538 pages, 6 in. by 9 in., illustrated. Cloth bound. Price, $7.50.*

The book is primarily a tool for the application engineer. It describes the design, construction and application of controllers for electric motors, beginning with a general discussion of wiring diagrams, construction details and pilot devices as applied to all kinds of motor control. The book is then divided into two sections, one on d.c. motors and motor control, and the other on a.c. motors and motor control. It covers operation, characteristics and application of each motor and the methods used to control it.

The third edition has been revised and expanded to keep pace with recent developments. It contains new information on circuits and devices, and includes calculations for regulation of voltage, speed, tension, etc. Also added are descriptions of electronic amplifiers, rotating regulators, positioning servomechanisms and basis principles of regulating problems.

The author was graduated from the Carnegie Institute of Technology with a B.S.E.E., and has served with Cutler-Hammer, Inc., respectively, as supervisor of the steel mill division of the Engineering Department, general supervisor of all engineering works, assistant chief engineer, manager of engineering and vice president in charge of engineering, the position he now holds.

"SAND IN THEIR SHOES." *By Franklin M. Reck; 153 pages, 6 in. by 8½ in.; published by American Steel Foundries, 401 N. Michigan ave., Chicago 11.*

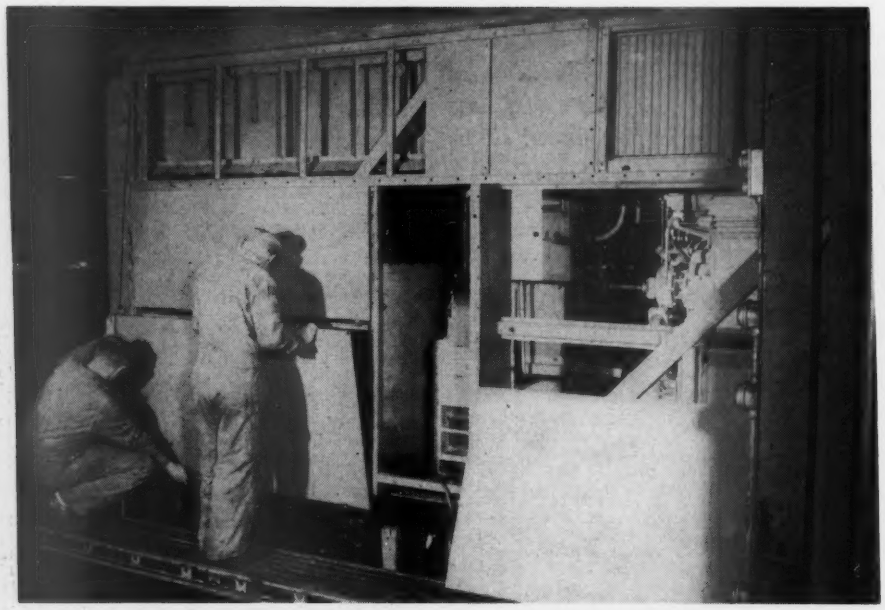
A concise and action-packed account of the development and accomplishments of American Steel Foundries from its incorporation in 1902 to the present with 9 plants in 11 cities, 20 times its original productive capacity and a diversity of products and interests undreamed of in the early days. The contribution of this company to railroad progress and hence the industrial might of the nation in times of war as well as peace is clearly pictured. The book tells no story of infallibility or unbroken success, but of men who have been right oftener than wrong, who have overcome many crisis and discouragements and in the last turbulent half century played an important part in the growth of industrial America.

Personal Mention

Obituaries

* Indicates photograph

NEW DEVICES



Application of new E-M all-metal side panels to General Motors road diesel.

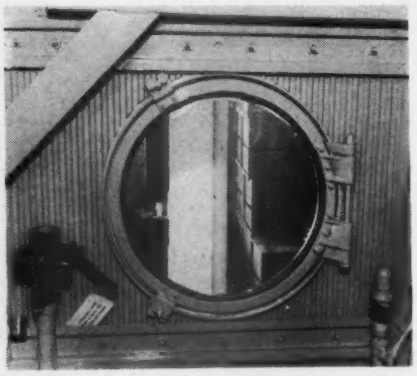
All-Metal Panels For GM Diesels

The Electro-Motive Division, General Motors Corporation, has developed and is now producing for use on passenger and freight locomotive units a new type of all-metal side panel said to provide greater strength and durability at substantially less cost. The new panels have successfully passed extensive service tests and are now ready for application to all G M road diesel units, new or old.

The all-metal panels are made in standard sizes as required up to 4 ft. wide by about 12 ft. long and ⅜ in. thick. Each panel consists of a 20-gage steel outer sheet permanently bonded to a corrugated steel inner sheet of the same weight, with a narrow 20-gage steel binding strip applied around all four edges. The pitch of corrugations in the stiffener sheet is ten per foot. The panel is held in place on the locomotive side with the same battens in previous construction.

The bonding method used is one extensively applied in recent years by the aviation industry and consists of using a special Buna-N synthetic, rubber-base heat-setting adhesive which bonds the panel into an integral unit, strong, light in weight and easily handled. All parts of the panel are united at one time in an ingenious press under a combination of heat and pressure with automatic control of the time cycle.

The new construction is said to resist temperature from 60 to 450 deg. F, prevent rust and corrosion on interior surfaces and have a probable service life of 25 years under normal conditions. All-metal panels are turned out by the new process at Electro-Motive on a modern conveyorized assembly line at the rate of one complete panel, ready to install, every 4 min.



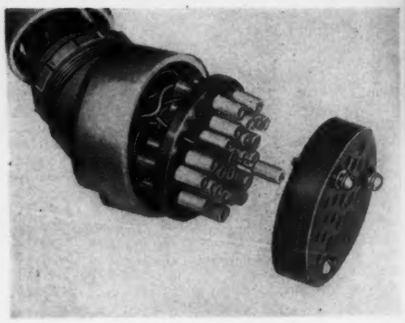
A sash set in the all-metal panel as seen from inside the locomotive.

High Flash Point Emulsion Cleaner

Pennsalt EC-54, a new type of emulsion cleaner, has been developed for metal cleaning by the Pennsylvania Salt Manufacturing Company, Philadelphia. This emulsifiable liquid has a flash point of 260 deg. F., a fire point of 300 deg. F., and 95 per cent boils within a range of 500 deg. to 600 deg. F. Therefore, it will not boil off or evaporate when used at high temperatures in a power washing unit. Its flash point is well above temperatures normally used in emulsion spray cleaning. The advantages claimed because of these characteristics are that there is negligible loss through evaporation; no solvent vapors condense on plating tanks, the fire hazard is minimized during shut-downs or in drains or sewers, and the cleaning solution can be used at higher temperatures to assure maximum detergency on high melting point soils.

Ferrous parts cleaned with EC-54 are protected against in-plant rusting for a period of one to six weeks, or longer by the use of stronger solutions and by the omission of the rinse following the cleaning stage.

On non-ferrous metals, it will not tarnish aluminum, magnesium, brass or zinc. One cleaning unit can be used to process all metals in a given plant.



Jumpers for Diesels

The Pyle-National Company, Chicago 51, has introduced a new diesel locomotive control jumper with 16-21-24 or 27 poles. The jumper, designated as number WWPAJ, combines the flexibility and resiliency of all-rubber head jumper with the light weight, strength and individual parts renewability of the all-metal head jumper.

Rubber made of a compound unaffected by oil heat and cold and possessing high arc resistance is used for a resilient shock-absorbing face plate which will withstand severe blows without cracking or becoming out-of-round. Rubber is also used for a flexible, fabric-reinforced rubber conduit with long tapered integrally molded grommets on each end which encloses the individual conductors.

Resilient rubber sleeves serve to prevent abrupt flexing of leads and avoid current creepage at the wire terminals without the use of sealing compound.

An aluminum alloy plug housing with lock cap and lock nut in addition to reinforcing the assembly, makes complete dismantling possible for inspection, repair and replacements.

All strain is confined to the exterior components including the rubber conduit, tapered grommets and metal plug housings.

(*Continued on page 120*)

WHAT CAUSED THIS

ROUGH CAR HANDLING?

CORROSION?

yes, BUT . . . there are *three* reasons for the increasing number of cars you see in this condition on sidings and rip tracks. The *third* cause is inadequate design—*outdated construction!*

International

THERE'S A NEW PRECISION IN FREIGHT CAR CONSTRUCTION

Shippers *must* be served! Cars *must* go through classification yards speedily and be able to stand high speeds on the line! You can't hold back today's progress to match yesterday's construction techniques—look to *International* for the new precision that makes *today's* cars for *today's* pace!

International's CORRECTIVE DESIGN

Heavier end side panel of 3/16" plate replaces conventional .10" sheet. Shorter span plate incorporates "W" section corner post as well as the first intermediate post—provides substantial anchoring of the end. All-welded at all points to eliminate moisture entry points and infestation harbors!

INTERNATIONAL STEEL COMPANY RAILWAY DIVISION

EVANSVILLE 7, INDIANA

No strain is imposed on the interior current carrying conductors and contacts.

The metal plug housing also includes an integral damage-proof polarizing guide lug and a positive locking seat for the receptacle cover hook.

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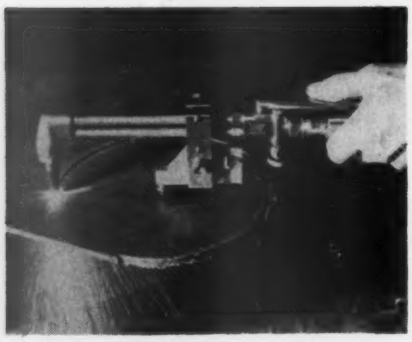

Gas-Flame Torch Cutting Guides

Cutting guides for individual gas flame metal-cutting torches have been devised by New Era Engineering Co., Chicago 16. These devices are designed to provide workmen with attachments to cut circles, straight lines, bevels and other shapes with no special training.

They are made in various sizes and styles to fit all makes of torches, from 70 deg. to 90 deg. models, and are offered in three types: a small circle guide for cutting circles from 1 to 15 in. dia., a large guide for circles 10 to 66 in. dia., and a straight-line guide which can also be arranged for straight and 60 deg. and 45 deg. bevel cutting.

The guides can be attached to the torches in 2 or 3 min; finger-tip adjustments require no tools. They are offered singly or in kits.

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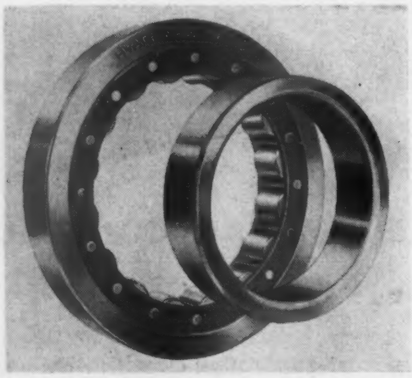

Pinion End Traction Motor Bearing

Hyatt Bearings Division of General Motors Corporation, Harrison, N. J., is now in production on a newly-designed pinion-end motor armature bearing for diesel locomotive service. The new design emphasizes a roller-riding cage. The cage is assembled by a new Hyatt process which insures its permanent rigidity under severe operating conditions. The cage and rollers can be removed from the bearing as a unit to permit quick, easy, complete inspection of all operating surfaces.

While retaining the large load-carrying capacity of former designs, the manufacturer states that the new bearing offers greater life expectancy because of more efficient lubrication and additional capacity.

■

Electrical Insulating Varnish

This new compound, designed for equipment where high speeds and/or high vibration would cause wire movement and electrical failures, has been introduced by Irvington Varnish & Insulator Company, Irvington, N. J.

Know as formation No. 140, the product is said to withstand class B temperatures. It is, according to the manufacturer, resistant to oils, chemicals and moisture and to have excellent electrical properties and long storage and dip tank life.

Inexpensive naptha can be used for thinning, thereby cutting down solvent costs.

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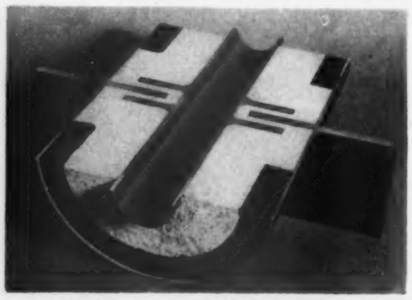


Underground Pipe Insulating Anchor

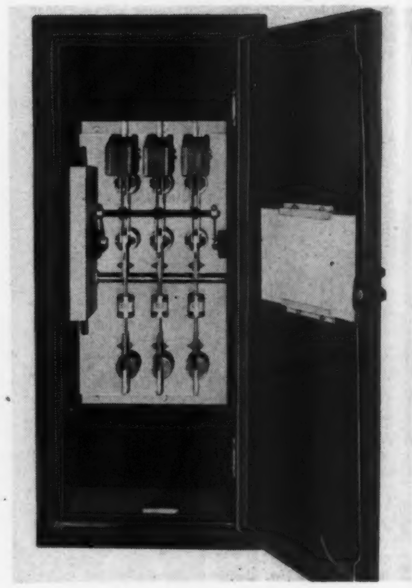
An insulated anchor for use in underground insulated pipe systems conveying hot or cold liquids or gases that serves to minimize heat losses at anchorage points and prevent pipeline corrosion due to electrolytic action has been developed.

Marketed by Durant Insulated Pipe Company, Palo Alto, Calif., the device is so constructed that contact is eliminated between the anchor plate and the pipe. The plate is insulated from the pipeline both thermally and electrically by a non-compressible block of Transite sheet material.

■

Load Interrupter Switch

A metal enclosed Dis-ruptor switch for 600-volt a.c. or d.c. service is announced by Delta-Star Electric Division, H. K. Porter Company, Inc., Chicago 12, combines the functions of disconnect and load interrupter. It incorporates arc-interrupting chambers with a quick-make, quick-break



mechanism. The manufacturer states that it has been thoroughly tested under load conditions and has proved able to interrupt its rated capacity with an ample safety factor.

The switches are available in ratings of 400, 600, 1,200, 2.000 and 3,000 amp., as 2-pole or 3-pole units with or without provisions for "Amp-trap" fuses.

■

Broached Surface Bushing

This device, with its broached surfaces, does not require close tolerance machining, whereas conventional type bushings have to be inserted in holes drilled and reamed to very close tolerances.

Known as "Bushing with the Broach," and manufactured by Aeroquip Corporation, Jackson, Mich., it has a series of minute cutting edges on the outside which cut their way into position with uniformly accurate results. Once installed, the bushing is firmly located in position.

Greater variations in the size of the locating hole are allowable. The normal hole tolerance of the conventional type bushing is 0 to 0.0005 in. The new product will work satisfactorily with a maximum tolerance of 0.002 in.

■

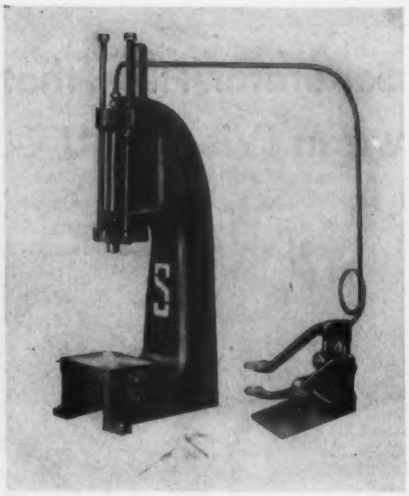
Anti-Corrosive Galvanized Locknut

This device has been designed for use in locations where alkali, salt water and other corrosive elements tend to corrode nuts and bolts. The locknut, available in ⅜ in. to 1-⅜ in. sizes, has a square body and is held in position with a locking insert. It was introduced by the Security Locknut Corporation, Melrose Park, Ill.

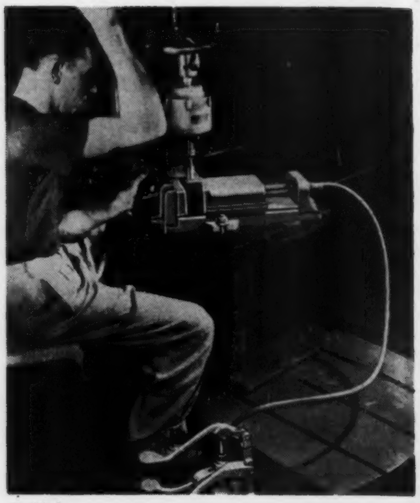
Its locking insert is slightly elliptical. When the nut is applied, the bolt forces this elliptical retainer ring into the round, causing a high tension grip on the bolt. It can be removed any number of times without destroying locking power or damage.

(*New Devices continued on page 122*)

Speedvise



Speedpress



Drillvise

Hydraulic Machines

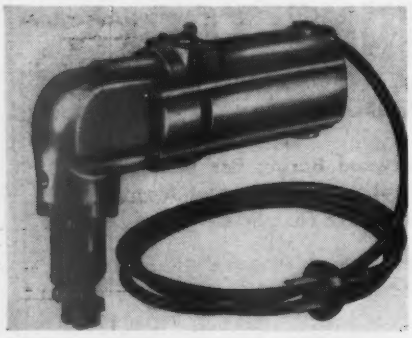
Hydraulically operated vises and presses which feature a fast-acting foot control which leaves the operator's hands free for manipulating the work are manufactured by the Studebaker Machine Co., 1221 S. 9th avenue, Maywood, Ill. Three of these are termed the Speedvise, the Drillvise and the Speedpress.

The Speedvise is designed for applications where speed, accuracy and controlled pressure are necessary on vise or clamping jobs, both for production work and tool room and maintenance use. Pressure can be built up with easy strokes from a feather touch to maximum. V-ways and gibs are adjustable for wear to give accurate alignment for long life. The Speedvise is available in two models, with a maximum pressure of 7½ tons and 5 tons. Both can be equipped with pipe jaws.

The Studebaker Hydraulic Drillvise mounts on the machine platen or a swivel base on the machine, table or bench and will hold pressures up to 7 tons. The front jaw is stationary, the rear jaw movable. The Drillvise has a length of 20⅝ in., width of 9 in. and height of 6¼ in. Throat depth is 3 in., the jaws 6 in. wide, and the opening between the jaws 5 in.

The Studebaker Speedpress is adaptable to such operations as broaching, assembling, piercing, oil groving, forming, pressing, flanging, and diveting. It has an 8-in. throat, a machined table for accurate work, an open base for work on long pieces, and applies pressure up to 7 or 12 tons, depending on the model.

The foot control for operating the above machines is a self contained hydraulic unit which requires no outside power. The center pedal moves the ram to contact the work in a single downward stroke. The right pedal exerts pressures up to maximum while the left pedal releases the pressure.



Heavy Duty Portable Nibbler

The Little Wonder, a portable nibbler that can cut through 14 gage stainless steel, galvanized iron and softer materials in proportion without distortion has been introduced by Fenway Machine Sales Co. Inc., Philadelphia 2.

This tool can be used as either a hand tool or mounted in a vise for bench operations. It also cuts holes in tubes and ducts without destroying the original contour.

The device has a minimum cutting radius of ⅞ in., is housed in an aluminum casting and weighs 7½ lb. It is 10 in. long, comes equipped with a universal motor. Anti-friction bearings are used on all rotating parts.

Non-Inflammable Paint Remover

Now available is a paint and varnish remover that does not require heat and removes the danger of fire in stripping operations. Any residue can be washed off with water so the metal can be painted immediately. It can be used on small or large areas, smooth and rough surfaces and can be used over and over again if not allowed to evaporate.

Produced by The Craftint Manufacturing Company, Cleveland 10, the formulation will not corrode aluminum, and should, according to the manufacturer, prove invaluable in preserving aluminum components for the railroad industry.

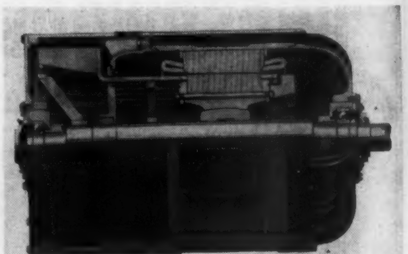
The product can also be used in maintenance of paint-spraying equipment to remove covering coats of paint.

■

High-Slip Motor

A totally enclosed, fan-cooled, high-slip induction motor, designed for use in acceleration of high-inertia loads such as punch presses, centrifuges, hoists, etc., has been announced by the General Electric Company's Small and Medium Motor Department, Schenectady, N. Y.

Designated as Type KRX, the new motor



is as much as 30 per cent smaller and 40 per cent lighter than conventional totally-enclosed fan-cooled high-slip motors. The space and weight reduction is the result of the motor's extended-bar design which provides efficient dissipation of the increased heat normally generated by high-slip motors.

Low-resistance rotor bars are extended on one end and pass through a rotating baffle plate. Beyond the baffle plate, the bars are brazed to strips of high-resistance metal, shaped to form a radial-blade fan. These fan blades, themselves, provide the higher rotor resistance necessary for high-slip characteristics. Thus, most of the rotor heat develops where there is a direct transfer to the cooling air.

The motor is available in 30 to 150 hp. at 900 and 1,200 r.p.m., 5-8 and 8-13 per cent slip. Voltage ratings are 220, 440 and 550.

(New Devices continued on page 145)

ESSO COBLAX

LAB TESTED	PROVED ON THE RUN
continuing research assures high quality . . . makes certain that Esso Railroad Products keep pace with latest engine design and developments.	— constant on-the-job checks by Esso Sales Engineers assure the dependable performance of all Esso Railroad Products.

Esso Coblax Lubricants provide highly dependable gear lubrication for traction motor drives on electric and diesel-electric locomotives; gas electric and multiple-unit cars; and many other locomotive and car lubrication requirements. Esso Coblax is available in a wide range from oils to semi-solid products. Be sure to call on Esso for *any* fuel or lubricating problem.

ANOTHER DEPENDABLE ESSO RAILROAD PRODUCT

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ESSO STANDARD OIL COMPANY — Boston, Mass. — New York, N. Y.—Elizabeth, N. J. — Philadelphia, Pa. — Baltimore, Md. — Richmond, Va. — Charleston, W. Va. — Charlotte, N. C.—Columbia, S. C.—Memphis, Tenn. — New Orleans, La.

NEWS

3,065 Power Units Installed in 1952

CLASS I railroads in 1952 put 2,415 new locomotives, or 3,065 units, in service, the Association of American Railroads has announced. This was 143 locomotives, or 397 units, below the record number installed in 1951, for which year the total was 2,558 locomotives, or 3,462 units. Of the total placed in service in 1952, 171 locomotives were installed in December, compared with 192 in December 1951.

New locomotives put in service in 1952 included 2,389 diesels (3,038 units), 19 steam, one electric and six gas turbine electrics. Locomotives installed in 1951 include 2,537 diesels (3,438 units), 18 steam and three electrics.

On January 1, 1953, Class I roads had 832 new locomotives (958 units), on order. These included 788 diesels (914 units), 15 steam, 10 electric and 19 gas-turbine-electrics. One year earlier Class I roads had 1,739 new locomotives (2,207 units), on order, including 1,709 diesels (2,176 units), 19 steam, one electric and 10 gas turbine electrics.

B.C.R. To Hold Annual Meeting March 6

CURRENT Research and Opportunities in the mining and use of coal will be discussed at the annual meeting of Bituminous Coal Research, Inc., to be held at the Netherland Plaza Hotel, Cincinnati, March 6. Among the speakers will be Walter J. Tuohy, president of the Chesapeake & Ohio and a member of B.C.R.'s Locomotive Development and Plan of Action Committees, and John I. Yellott, director of research of the gas-turbine program. Mr. Tuohy will discuss advancements made during the past year on the development of coal-fired gas turbines under B.C.R.'s Locomotive Development Program, and Mr. Yellott will cite opportunities in the application of coal-fired gas turbines.

Should Diesel Crankcase Oils Be Mixed?

HEAVY-DUTY lubricating oils used in diesel engines should not be mixed, because non-mixing promotes better engine performance, according to W. K. Simpson, fuel and lubrication engineer of the Electro-Motive Division of General Motors Corporation.

Speaking before the Southern and Southwestern Railway Club at Atlanta, Ga., on January 15, Mr. Simpson said he would encourage the thinking that more money should be spent on lubricating oils, because an analysis of diesel operating costs shows that 65 per cent are chargeable to fuel oil and only 2.6 per cent to lubricating oils. not only does non-mixing produce better engine performance, he said, but it also promotes better relationships between railroads and oil companies—which is particularly important since the amount of fuel oil required when railroads are fully dieselized will be about 225,000 to 250,000 barrels per day.

Before presenting any conclusions with respect to the mixing of lubricating oils, Mr. Simpson reviewed arguments for and against mixing. The arguments against mixing are:

(1) Non-mixing simplifies handling;

(2) Mixing usually results in dirty oil conditions;

(3) Mixing upsets balance of additive combinations;

(4) Mixing puts the brakes on research because it provides no incentive to alter composition of any oil that is in a blend;

(5) Oil companies will not guarantee mixed oils; and

(6) Oil companies have no pride in performance of mixed oils.

Mr. Simpson listed the following circumstances under which mixing of heavy-duty oils will be satisfactory:

(1) The oils blended are prone to be compatible;

(2) More favorable results can be obtained in engines operated in lower horsepower ratings—switching, light passenger and light freight service;

(3) Pre-blending of oils more satisfactory but also more complicated and un-

ORDERS AND INQUIRIES FOR NEW EQUIPMENT PLACED SINCE THE CLOSING OF THE FEBRUARY ISSUE

DIESEL-ELECTRIC LOCOMOTIVE ORDERS

Road	No. of Units	Horse-Power	Service	Builder
Denver & Rio Grande Western	5[1]	1,500	Road switch	Electro-Motive
Missouri Pacific	7A[2]	1,600	Freight	Alco-G. E.
	11B[2]	1,600	Freight	Alco-G. E.
	1[2]	1,600	Passenger	Alco-G. E.
	28[2]	1,500	Road switch	Electro-Motive
Gulf Coast Lines	5[2]	1,500	Road switch	Electro-Motive
International Great Northern	5[2]	1,500	Road switch	Electro-Motive
Union Railway (Memphis)	7[2]	1,200	Switch	Baldwin-Lima-Hamilton
Monongahela	12[3]	1,200	Switch	Baldwin-Lima-Hamilton
Western Pacific	4[4]	1,500	Road switch	Electro-Motive

FREIGHT CAR ORDERS

Road	No. of cars	Type of car	Builder
Burlington Refrigerator Express Co.	100[5]	50-ton meat refrigerator	Company shops
	30[5]	70-ton mechanical refrigerator	Company shops
Central of Georgia	50[6]	70-ton covered hopper	Pullman-Standard
Denver & Rio Grande Western	200[7]	70-ton gondola	General American
Duluth South Shore & Atlantic	100[8]	50-ton box	Pullman-Standard
Erie	50[9]	Cabooses	Internat'l Ry. Car & Equip. Mfg.
Great Northern	200[10]	50-ton flat	Pacific Car & Fdry.
Gulf, Mobile & Ohio	50[11]	70-ton covered hopper	Pullman-Standard
	400[11]	50-ton gondola	American Car & Fdry.
Union Tank Car Co.	250[12]	Tank	Company shops
Western Pacific	102	Flat	Company shops

PASSENGER-CAR ORDERS

Road	No. of cars	Type of car	Builder
Duluth, Missabe & Iron Range	1[13]	Rail diesel (RDC-3)	Budd Co.

[1] For April and May delivery.
[2] Delivery expected early this year.
[3] Class DES-B-1, equipped for multiple-unit operation. Estimated cost $1,284,672. Delivery expected in June.
[4] Estimated cost, $682,000. For delivery in April.
[5] Delivery of meat cars expected in July; mechanical cars, in June.
[6] Estimated cost, $362,769. Delivery scheduled for late April.
[7] For delivery during the third quarter of 1953.
[8] For delivery in July.
[9] Estimated base cost $485,000. Deliveries expected to start this month and continued for seven months. A lot of 50 cabooses previously ordered from the company's own shops has been cancelled.
[10] Estimated cost, $1,250,000. Delivery expected in fourth quarter of 1953.
[11] Hopper cars for delivery during the third quarter of 1953; gondola deliveries to begin in third quarter.
[12] For delivery later this year.
[13] Delivery expected shortly.

NOTES:

Central of Georgia.—This road plans to purchase 3,000 freight cars over a three-year period at a cost of $18,000,000. The first 1,000 units will be 50-ton box cars with wide doors for transporting paper, clay and other products, loading machinery for which requires wide-door openings. Their cost is estimated at $6,000,000 and delivery is expected next fall. The remaining 2,000 cars will be bought in 1954 and 1955. The road also will buy this year an unspecified number of heavy-duty flat cars, costing about $25,000 each.

Long Island.—The LI has started a rehabilitation program whereby 17 cars a month will be completely overhauled—stripped to bare shells and rebuilt, reupholstered and redecorated in a new customer-selected interior color scheme of blue and rose. The LI has 1,315 cars, about one-thirtieth of all coaches, passenger-baggage combination cars and baggage and mail cars in use in the entire country. Two overhauled cars each month will be equipped with new seats of the 3-2 variety, to increase the number of seats available in rush-hour trains.

New York Central.—To complete dieselization of the NYC will require expenditure of approximately $225,000,000 for additional diesel units, William White, president, said at a press luncheon in New York on February 2. The NYC soon will be in the market for diesels for 1954 delivery, he added, which will involve an outlay of approximately $20,000,000.

Pacific Fruit Express Company.—This company has received authorization from its joint owners—the Union Pacific and the Southern Pacific—to acquire 200 new 50-ft. refrigerator cars. Of the total, 100 cars will be mechanically refrigerated for handling frozen foods at near-zero temperatures. Delivery is expected at the year's end.

Savannah & Atlanta.—Directors of the S&A have authorized purchase of 200 freight cars at an estimated cost of $1,200,000.

doubtedly of only academic interest; and

(4) Accidental or small percentage mixing can probably be accomplished without harmful effect.

The compatibility of oils is not easy to determine, Mr. Simpson said; he told of two oil companies which came out with new oils not compatible with their old oils. Also, different oils have an effect on the nature of engine deposits and a change in these deposits usually has an adverse effect on engine performance. He said it is difficult to control mixing of oils on large railroads operating trackage in many directions, but rather easy to control it on straight line railroads.

Eight major oil companies are conducting research on E.-M.D. locomotives, the goal being a more durable engine that will run longer with less wear, according to Mr. Simpson. Remarkable progress has already been made, he said, and better performance will be obtained in future with better lubricating oils permitting possible utilization of lower priced fuel.

Mr. Simpson was assisted in the discussion of the meeting's topic, "Mixing of Crankcase Oils," by a panel consisting of A. C. Spencer, lubrication engineer, Esso Standard Oil Company; R. W. Van Sant, chief of fuel and lubricants engineering, Gulf Oil Corporation; T. Renison, eastern sales representative, Shell Oil Company, and E. G. Mittlestaedt, eastern manager, railroad sales, Sinclair Refining Company.

The oil company representatives were in general agreement with Mr. Simpson and Mr. Van Sant, who spoke of the complex structure of lubricating oils both in respect to base stock and additives. He could not see how the new synthetic additives under development could be held in balance if variables introduced by mixing were added.

Mr. Van Sant also outlined the fuel oil situation. Because of the greater demand for gasoline at one end of the cracking process of each barrel of crude oil, and for residuals and Bunker C at the other end, the percentage of diesel fuel oil obtained from each barrel is less. Supply has been maintained only by increasing refinery facilities and processing more barrels of crude oil. There is an added squeeze in the diesel fuel oil range due to the increasing demand for domestic heating oil and for jet engine fuel. He said these factors would be an influence working against the lowering of the price of diesel fuel oil.

In general the railroads represented at this meeting do not mix crankcase oils. Even the larger systems try to segregate operation of units as a general policy but do get some mixing of oils. Mr. Simpson said that mixing of oils would work well if any railroad established a program for mixing oils with the benefits going to the engine builders, who would probably sell twice as many replacement parts.

Miscellaneous Publications

The Captain's Idea.—Rust Oleum Corporation, 2799 Oakton Street, Evanston, Ill. A 16 mm., 30-min. film shows ways to stop rust and cut costs in the railroading, steel, petroleum, marine, and many other industries. Film, in full color, with synchronized sound, includes a fast-moving plot and scenario with a complete cast of talent.

SUMMARY OF MONTHLY HOT BOX REPORTS

Month	Foreign and system freight car mileage (total)	Cars set off between division terminals account hot boxes: System	Foreign	Total	Miles per hot box car set off between division terminals
July, 1950	2,745,932,894	....	....	23,957	114,619
August, 1950	2,937,455,020	7,422	15,490	22,912	128,206
September, 1950	2,974,297,739	6,541	12,881	19,422	153,141
October, 1950	3,165,997,915	4,343	8,935	13,278	238,439
November, 1950	2,868,871,913	2,536	5,331	7,867	364,672
December, 1950	2,813,042,212	2,278	5,968	8,246	341,140
January, 1951	2,840,847,511	2,870	8,436	11,306	251,269
February, 1951	2,425,226,454	4,528	14,063	18,591	130,452
March, 1951	3,063,173,942	3,667	10,078	13,745	222,857
April, 1951	2,996,562,763	3,702	8,914	12,616	237,521
May, 1951	3,013,634,782	5,631	13,737	19,368	155,599
June, 1951	2,874,873,495	7,074	15,376	22,450	128,057
July, 1951	2,768,920,095	8,886	18,823	27,709	99,929
August, 1951	3,009,371,111	9,023	19,092	28,115	107,038
September, 1951	2,925,570,545	6,472	13,565	20,037	146,008
October, 1951	3,116,490,095	4,131	9,053	13,184	236,284
November, 1951	2,939,503,144	2,022	4,405	6,427	457,368
December, 1951	2,752,316,133	2,130	5,398	7,528	365,611
January, 1952	2,824,298,630	3,208	7,197	10,405	271,437
February, 1952	2,809,162,671	2,723	6,473	9,196	305,477
March, 1952	2,943,812,727	2,594	5,877	8,471	347,517
April, 1952	2,766,313,714	3,826	7,759	11,585	238,784
May, 1952	2,918,508,445	6,020	10,938	16,958	172,102
June, 1952	2,672,512,889	8,466	14,495	22,961	116,394
July, 1952	2,575,298,912	10,566	15,833	26,399	97,553
August, 1952	2,924,917,122	11,658	17,535	29,193	100,192
September, 1952	2,931,129,734	7,536	13,608	21,144	138,627
October, 1952	3,093,990,289	4,058	8,053	12,111	255,469
November, 1952	2,984,101,808	2,198	4,501	6,699	445,455

SELECTED MOTIVE POWER AND CAR PERFORMANCE STATISTICS

FREIGHT SERVICE (DATA FROM I.C.C. M-211 AND M-240)

Item No.		Month of October 1952	1951	10 months ended with October 1952	1951
3	Road locomotive miles (000) (M-211):				
3-05	Total steam	17,554	24,382	172,326	252,322
3-06	Total, Diesel-electric	30,158	25,455	272,241	224,193
3-07	Total, electric	771	833	7,570	8,142
3-04	Total, locomotive-miles	48,540	50,671	452,465	484,680
4	Car-miles (000,000) (M-211):				
4-03	Loaded, total	1,834	1,857	16,497	17,309
4-06	Empty, total	938	951	8,914	8,804
6	Gross ton-miles-cars, contents and cabooses (000,000) (M-211):				
6-01	Total in coal-burning steam locomotive trains	29,519	44,847	303,504	443,090
6-02	Total in oil-burning steam locomotive trains	9,739	12,053	84,208	120,393
6-03	Total in Diesel-electric locomotive trains	85,271	71,830	756,763	627,425
6-04	Total in electric locomotive trains	2,069	2,277	20,931	22,304
6-06	Total in all trains	126,789	131,017	1,166,580	1,213,340
10	Averages per train-mile (excluding light trains) (M-211):				
10-01	Locomotive-miles (principal and helper)	1.03	1.04	1.03	1.04
10-02	Loaded freight car-miles	41.30	40.50	39.90	39.60
10-03	Empty freight car-miles	21.10	20.80	21.60	20.20
10-04	Total freight car-miles (excluding caboose)	62.40	61.30	61.50	59.80
10-05	Gross ton-miles (excluding locomotive and tender)	2,855	2,860	2,823	2,779
10-06	Net ton-miles	1,307	1,350	1,299	1,304
12	Net ton-miles per loaded car-mile (M-211)	31.70	33.30	32.50	32.90
13	Car-mile ratios (M-211):				
13-03	Per cent loaded of total freight car-miles	66.20	66.10	64.90	66.30
14	Averages per train hour (M-211):				
14-01	Train miles	17.40	16.80	17.50	16.90
14-02	Gross ton-miles (excluding locomotive and tender)	48,946	47,458	48,938	46,415
14	Car-miles per freight car day (M-240):				
14-01	Serviceable	48.00	48.60	44.90	46.20
14 02	All	45.70	46.30	42.60	44.10
15	Average net ton-miles per freight car-day (M-240)	957	1,019	901	961
17	Per cent of home cars of total freight cars on the line (M-240)	41.10	36.70	43.50	37.10

PASSENGER SERVICE (DATA FROM I.C.C. M-213)

Item No.		Month of October 1952	1951	10 months ended with October 1952	1951
3	Road motive-power miles (000):				
3-05	Steam	5,699	8,517	68,051	101,013
3-06	Diesel-electric	19,358	17,466	186,178	163,146
3-07	Electric	1,584	1,606	16,188	16,177
3-04	Total	26,641	27,589	270,425	280,336
4	Passenger-train car-miles (000):				
4-08	Total in all locomotive-propelled trains	266,470	269,711	2,704,762	2,732,448
4-09	Total in coal-burning steam locomotive trains	30,639	44,577	351,836	529,379
4-10	Total in oil-burning steam locomotive trains	21,415	28,924	253,698	327,172
4-11	Total in Diesel-electric locomotive trains	196,459	178,488	1,919,743	1,702,489
12	Total car-miles per train-miles	9.70	9.56	9.78	9.58

YARD SERVICE (DATA FROM I.C.C. M-215)

Item No.		Month of October 1952	1951	10 months ended with October 1952	1951
1	Freight yard switching locomotive-hours (000):				
1-01	Steam, coal-burning	815	1,141	8,056	12,088
1-02	Steam, oil-burning	177	244	1,666	2,380
1-03	Diesel-electric[1]	3,498	3,177	31,524	29,470
1-06	Total	4,514	4,587	41,482	44,194
2	Passenger yard switching hours (000):				
2-01	Steam, coal-burning	24	38	275	459
2-02	Steam, oil-burning	10	13	107	130
2-03	Diesel-electric[1]	260	248	2,555	2,419
2-06	Total	327	333	3,269	3,343
3	Hours per yard locomotive-day:				
3-01	Steam	7.70	7.80	7.00	7.80
3-02	Diesel-electric	16.90	17.30	16.10	17.20
3-05	Serviceable	15.20	14.80	14.30	14.40
3-06	All locomotives (serviceable, unserviceable and stored)	13.40	12.70	12.40	12.40
4	Yard and train-switching locomotive-miles per 100 loaded freight car-miles	1.71	1.72	1.74	1.77
5	Yard and train-switching locomotive-miles per 100 passenger train car-miles (with locomotives)	0.76	0.77	0.75	0.76

[1] Excludes B and trailing A units.

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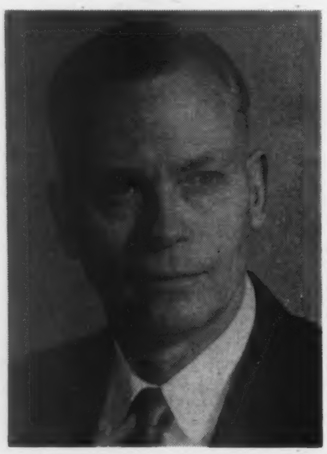
SUPPLY TRADE NOTES

General Motors Corporation.—*Warren A. Thomas,* sales manager of the La Grange factory branch of the *Electro-Motive Division* of *General Motors* has been named manager of the rebuild section of the sales department.

Mr. Thomas joined Electro-Motive in 1936 as an assembler in the locomotive division, and later served as foreman and service technician assigned to the United States Navy. Following World War II, he was manager of the diesel locomotive training center; then manager of the statistics and market analysis section of the sales department.



Warren A. Thomas

C. W. Kalchthaler has been appointed assistant to general sales manager of the *Hyatt Bearings division* of General Motors, with headquarters at Harrison, N.J. Mr. Kalchthaler has been assistant manager of the Hyatt Motor division sales office in Detroit. *F. H. Webster,* formerly assistant manager of the Western sales division of the Hyatt division, has been appointed manager of the sales division, with headquarters at Chicago. He succeeds *C. L. Newby,* who has retired after 34 years of service.

■

Joseph Dixon Crucible Company.—*E. C. Bleam* and *R. E. Goodfriend,* formerly sales representatives of the Joseph Dixon Crucible Company, have been promoted to district supervisors, with headquarters in Chicago and Columbus, Ohio, respectively.

■

Aluminum Company of America.—A new professorship in mechanical engineering has been established at the Carnegie Institute of Technology through a grant from the Aluminum Company. Dr. Dennistoun Wood VerPlanck, professor and head of the Mechanical Engineering Department at Carnegie, will hold the new chair, which will be named the "Alcoa Professorship in Engineering." Part of the grant of $15,000 a year will be used for research and equipment "to strengthen fundamental research in the general field of mechanical engineering, as well as in specific problems that exist in the aluminum industry." Dr. VerPlanck plans to spend part of his summer months in Alcoa plants searching for practical problems to bring to the classroom. The new grant is in addition to the endowed Alcoa Professorship of Light Metals now held by Dr. Frederick Rhines of the Metallurgical Engineering Department and the $2,600 graduate fellowship established at Carnegie by Alcoa some time ago.

■

Spring Packing Corporation.—*Thomas W. Milligan* has joined the staff of the Spring Packing Corporation as assistant vice-president, in charge of railroad activities.

In 1945, after attending Cornell University and spending four years in the Marine Corps., Mr. Mulligan started his business career with the Pyle-National Company, serving first as sales engineer at St. Paul, then as district manager at San Francisco, and later as manager, western division. In 1949 he was transferred to Chicago as manager, central division, a position from which he resigned to become vice-president of Sherman Olson, Inc., Chicago general contractors.

Thomas W. Milligan

■

Pyle-National Company.—*Charles H. Hobbs* has been elected vice-president in charge of sales of the Pyle-National Company, to succeed *D. I. Packard,* who has resigned. *William C. Croft* has been elected vice-president in charge of manufacturing. *Herbert F. Rothschild* has been appointed executive assistant.

■

Gustin-Bacon Manufacturing Company.—*George R. McMullen* has been appointed manager of the newly established Kansas City sales division of Gustin-Bacon, with offices in the Centennial building. The new division will cover a four-state area and concentrate on sales of the company's glass fiber insulation and industrial products. *W. M. Doughman* and *Grant I. Wyrick* have been assigned to the division as sales and service engineers.

The *Benjamin-Foster Company,* Philadelphia, has been appointed a distributor for Gustin-Bacon. The Philadelphia firm will handle Gustin-Bacon's Ultralite and Ultrafine glass-fiber insulations in its trade territory. The *Achenbach & Butler Co.,* which also has been handling Gustin-Bacon products in that area, will continue to do contract work with the two types of insulation.

■

Pullman-Standard Car Manufacturing Company.—*John W. Scallan,* vice-president of midwestern sales of the Pullman-Standard Car Manufacturing Company, has been named vice-president and general manager.

George L. Green, formerly executive vice-president of sales for the Spring Packing Corporation has been named a sales vice-president of Pullman-Standard.

Mr. Scallan, a graduate of Notre Dame University in 1925 with a degree in journalism, began his business career as a reporter on the Chicago Herald & Examiner. He joined the Pullman Company in 1926, and two years later became a sales agent of the Pullman Car & Manufacturing Corp., now Pullman-Standard. In 1932 he was appointed western district sales manager, in 1942 assistant vice-president, and in 1944 vice-president, midwestern sales.

Fabian Bachrach

John W. Scallan

Mr. Green, who studied at Phillips Exeter Academy and Yale University, began his business career in 1931 with the Continental Illinois National Bank & Trust Co. in Chicago. In 1934 he joined the Union Asbestos & Rubber Co., serving successively as service engineer, sales engineer, salesman and assistant vice-president. In 1944 he was railroad sales manager for the Elastic Stop Nut Corporation and later vice-president of the H. K. Porter Company. In 1947 he was appointed district manager in charge of western regional sales for the American Locomotive Company. In April. 1948, he joined Pullman-Standard as manager of miscellaneous sales, and in January. 1949 became associated with the Spring Packing Corporation.

■

Dearborn Chemical Company.— *Robert F. Carr, Jr.* has been elected vice-president of the Dearborn Chemical Company. Mr. Carr will make his headquarters in Chicago

(Continued on p. 135)

and will work with present heads of the firm's sales department to promote general overall sales of all Dearborn products. *Leo Flinn*, sales and service representative, has been appointed to the newly created position of supervisor of No-Ox-Id sales and service, with headquarters at Chicago.

■

FARR COMPANY.—*Donald S. Harworth* has been appointed southern division sales manager of the Farr Company of Los Angeles.

Mr. Harworth is a mechanical engineer and a graduate of the General Motors Institute. He recently completed his second tour of duty with the United States Army, and was discharged as a major.

The Johnson Filter Sales Company, Cleveland, the *Pittsburgh Air Filter Service Company*, Pittsburgh, and Air Filter Sales & Service-Detroit, Detroit, will represent Farr sales and service in their respective areas.

■

AEROQUIP CORPORATION. — *George J. Fischer* has been appointed vice-president, sales, and *Matthew J. Betley*, vice-president, manufacturing, of Aeroquip Corporation, Jackson, Mich. Mr. Fischer was previously general sales manager. Prior to joining

G. J. Fischer

Aeroquip, he was associated with the B. F. Goodrich Company of Akron, Ohio, for 18 years. He is a graduate of Heidelberg College and completed his academic training with post-graduate work in the Harvard School of Business Administration.

■

ALLOY RODS COMPANY.—The Alloy Rods Company has appointed the *Mississippi Supply Company*, Chicago, as authorized distributor for its complete welding rod line to a group of railroads in the Chicago, St. Paul, Minneapolis and St. Louis areas.

■

UNITED STATES STEEL COMPANY.— *Robert J. Haslett*, office manager—sales of the *National Tube Company*, a subsidiary of the United States Steel Corporation, at Gary, Ind., has been appointed assistant to manager—sales, tubing specialties.

■

GREAT LAKES STEEL CORPORATION.— *William A. Baldwin*, previously in charge of railroad sales for the Reflective Products division of the Minnesota Mining & Manufacturing Co., has been appointed sales representative for the Steel Floor division

of the Great Lakes Steel Corporation, with headquarters at 20 North Wacker drive, Chicago. He will be associated with *Edward W. Fitzgerald* in sales and servicing of nailable steel flooring to railroads with headquarters in the Chicago and Minneapolis-St. Paul areas.

■

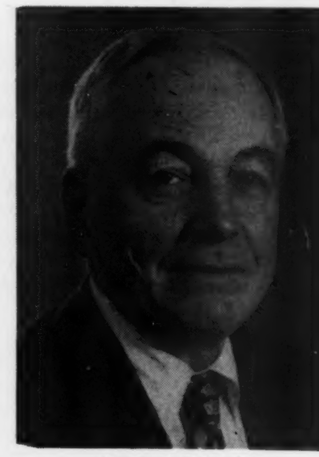
WILLIAM G. CHRISTY has opened an office as consulting engineer at 37 Park Row, New York 38. Mr. Christy was formerly director of the Bureau of Smoke Control of the City of New York.

In 1925, when chairman of the St. Louis Section, American Society of Mechanical Engineers, he helped organize the Citizens' Smoke Abatement League of St. Louis and became its executive secretary. Prior to his service in New York he was for 20 years smoke abatement engineer of Hudson County, N.J., during which he worked closely with the railroads in improving smoke conditions across the Hudson river from New York City.

■

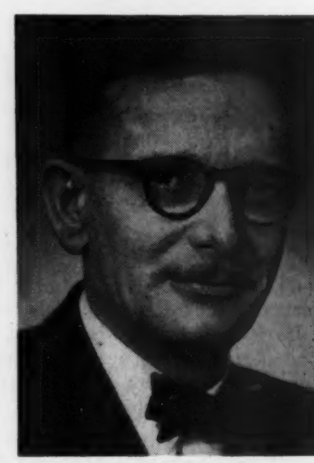
TOWNSEND COMPANY.—*Robert J. Ritchey* has been appointed assistant general sales manager of the Townsend Company, New Brighton, Pa. Mr. Ritchey has been director of the market development division of the United States Steel Company since January 1951.

AMERICAN LOCOMOTIVE COMPANY.—*Hunter Michaels* has been appointed vice-president—operations, with direct responsibility for all plant operations, and *D. W. Cameron* as vice-president—manufacting, in charge of manufacturing operations at all plants. *Alexander Ross* has been appointed chief engineer, and *H. R. Sennstrom* executive engineer, of Alco.



Hunter Michaels

Mr. Michaels, in 1923, joined the Railway Steel Spring Company, which was purchased by American Locomotive in 1926. In 1935 he was appointed district sales manager at Cleveland. He has been vice-president in charge of the Railway Steel Spring division since 1950 and director of the division since 1944.



Alexander Ross

Mr. Ross has been associated with Alco since 1932, when he joined the engineering department of the affiliated Montreal Locomotive Works at Montreal. In 1940, at the request of the Canadian government, he was temporarily assigned in charge of engineering of the munitions division of the Canadian National. He returned to Alco in 1941 in charge of locomotive engineering, and early in 1946 was transferred to Schenectady, N.Y., as assistant to director of locomotive engineering. Mr. Ross later was appointed mechanical engineer, chassis design, and in October 1952 was appointed engineer in charge of locomotive design.

Mr. Sennstrom joined Alco's engineering department in 1940, specializing in laboratory and diesel-engine development work.

In 1946 he was appointed superintendent of the diesel engine laboratory, and in 1949 research and testing engineer in charge of all laboratory work. Mr. Sennstrom directed pioneer work in use of the spectroscope for analyzing diesel engine lubricating oil in locomotive maintenance.

H. R. Sennstrom

Mr. Cameron, formerly operations manager at Montreal Locomotive Works and more recently located at Alco's Schenectady plant, started his career in the locomotive industry in 1917 as an apprentice machinist with Montreal Locomotive. He has held supervisory and executive positions at the Schenectady plant since 1925, becoming general superintendent in 1947 and assistant manager in 1951.

■

Quaker Rubber Corporation.—*J. R. Alexander* has been appointed general sales manager of the Quake Rubber Corporation, division of the H. K. Porter Company.

Mr. Alexander joined Quaker in 1944 as a sales representative and later worked successively as city sales manager and district sales manager until his present promotion.

■

Automatic Transportation Company.—*George R. Hettinger* has been appointed manager of railroad sales for the Automatic Transportation Company, Chicago. Prior to his appointment Mr. Hettinger was railroad and transport sales representative.

■

Youngstown Steel Car Corporation.—*S. E. Biggs* has been elected vice-president in charge of operations of the Youngstown Steel Car Corporation. Mr. Biggs had been vice-president in charge of manufacturing of Trailmobile, Inc., a subsidiary of Pullman, Inc.

■

Pennsylvania Flexible Metallic Tubing Company.—*Richard T. Patriquin* has been appointed New York sales manager. Mr. Patriquin joined the company as a salesman in the Philadelphia territory and most recently was field representative for the vice-president.

■

Hydraulic Press Mfg. Co.—*William H. Bennett* has been appointed director of engineering.

Mr. Bennett became associated with the company in 1939 on a specialized training program from the University of Cincinnati;

where he received an M. E. degree in 1943. Upon graduation he returned to Hydraulic Press in sales and engineering work. During World War II, he spent 28 months with the 35th Division, United States Army Engineer Corps, part in the European Theatre, where he served as First Lieutenant. He has been active in sales and engineering at the company since returning from the Army, and was assistant sales manager before assuming his new duties. Mr. Bennett also served as Chief of Forge and Press Equipment Section of the Metalworking Equipment Division of the National Production Authority in Washington.

■

SILVERCOTE PRODUCTS, INC.—*Edward A. Sipp* has been appointed vice-president in charge of sales of the railroad supply division of Silvercote Products, Inc. Mr. Sipp formerly was manager of the railway division of Reynolds Metals Company.

■

DOUBLE SEAL RING COMPANY.—*Francis L. Schmale*, formerly assistant sales manager for the Double Seal Ring Company, has been promoted to general sales manager at Fort Worth, Tex.

■

SHERWIN-WILLIAMS COMPANY.—*Fred W. Rusch*, who until recently headed Sherwin-Williams sales operations in Brazil, has been appointed assistant manager of the Company's Atlantic Coast Transportation Zone, with headquarters at New York.

PITTSBURGH SCREW & BOLT CORP.—*Robert B. Algie* has been appointed assistant vice-president—sales of the Pittsburgh Screw & Bolt Corp. Mr. Algie formerly was assistant manager of sales for the Jones & Laughlin Steel Corp., and recently was with the Forbes Steel Corporation.

■

RALSTON STEEL CAR COMPANY.—The Ralston Steel Car Company, Columbus, Ohio, has withdrawn entirely from the freight-car building field, after having served the railway industry in that capacity since 1905.

Some time ago, the company discontinued manufacture of new cars, but part of the plant remained active in manufacture of parts and in making freight car repairs. "Our board has now reached the conclusion that this activity no longer offers adequate profit and we are discontinuing our activities in this field," according to a statement made by President Frank M. Cogwill. No decision has been made as to what field the company will enter.

■

ELWELL-PARKER ELECTRIC COMPANY.—*C. Brenton, Cook*, formerly vice-president and a director of the Elwell-Parker Electric Company, Cleveland, has retired.

■

AMERICAN WHEELABRATOR & EQUIPMENT CORP.—American Wheelabrator: Mishawaka, Ind., has just completed construction of a plant specially designed for the manufacture of Wheelabrator Steel Shot, a new blast cleaning abrasive produced under the company's patented process.

The plant is completely mechanized and is equipped with electric melting furnaces and automatically controlled heat-treating equipment to assure constant uniformity of product.

■

AIR-MAZE CORPORATION.—The Air-Maze Corporation has opened a new plant and general offices at 25000 Miles Road, Cleveland 28. The plant itself has over 150,000 sq. ft. of floor space.

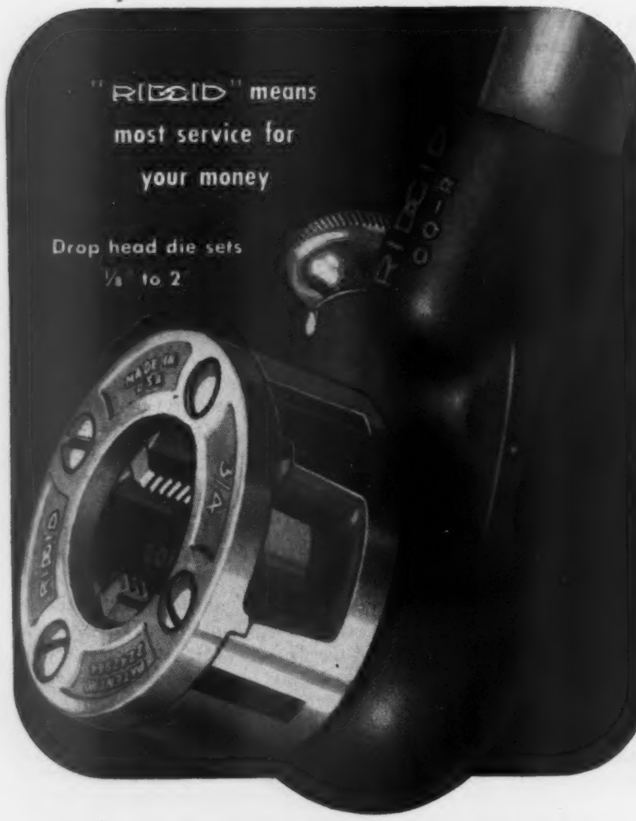
■

WESTINGHOUSE ELECTRIC CORPORATION.—*P. C. Smith*, formerly assistant to manager of the transportation and generator division of the Westinghouse Electric Corporation, has been appointed manager of the division.

W. R. Sugg, Jr., has been appointed assistant manager, and *G. A. Moore*, manager of manufacturing, of the transportation and generator division of the Westinghouse Corporation. Mr. Sugg formerly was manager of the divisions heavy traction section, and Mr. Moore, superintendent of manufacturing of the division.

■

CONSOLIDATED MACHINE TOOL CORPORATION.—*Roger E. Vaughan*, formerly assistant general manager of the Farrel-Birmingham Company's plant at Buffalo, N.Y., has been appointed assistant general manager of its subsidiary, the Consolidated Machine Tool Corporation, at Rochester, N.Y.



These popular extra-handy

RIDGID

drop head dies

give you clean threads fast and easily

★ Small, well balanced, clean cutting, these popular RIDGID ratchet threaders are a pleasure to work with. They save you time and effort because heads snap into drive ring from either side, won't fall out. Precision-cut alloy dies reverse for close-to-wall threads — no special dies needed.

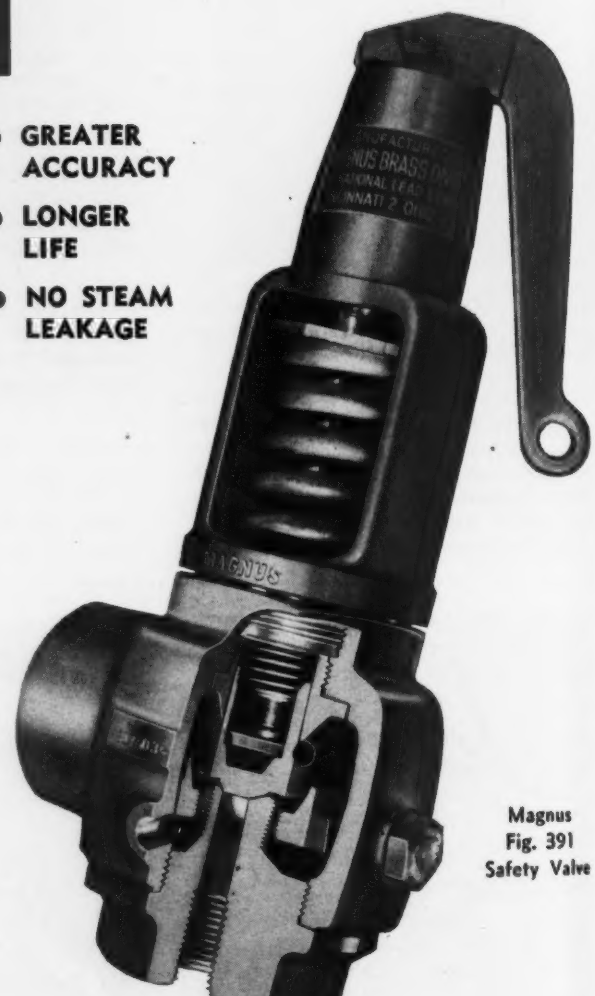
★ 00R and 0R, ⅛" to 1"; 111R and 11R, ⅛" to 1¼"; 12R, ⅛" to 2". Conduit dies, too—and free carrier with sets. Buy them at your Supply House.

THE RIDGE TOOL COMPANY • ELYRIA, OHIO

RIDGID
Work-Saver Pipe Tools

Magnus Safety Valve for Diesel Locomotive Steam Generators

- **GREATER ACCURACY**
- **LONGER LIFE**
- **NO STEAM LEAKAGE**



Magnus
Fig. 391
Safety Valve

Escape of steam into the engine cab is completely eliminated with the Magnus Fig. 391 Safety Valve. Added new features assure greater accuracy, positive safety and low-cost service.

Designed primarily for use on diesel locomotive steam generators, it is easily adjusted, has top and bottom guided feather valve, special spring and valve alloys. It is adjustable for either 245 or 300 pound boilers.

For further information write . . .

MAGNUS BRASS MFG. CO.
Subsidiary of National Lead Co.
525 READING ROAD, CINCINNATI 2, OHIO

AMERICAN CAR & FOUNDRY CO.—*Herbert D. Euwer* has been appointed chief engineer, passenger cars, for American Car & Foundry. Mr. Euwer, who will continue to make his headquarters at St. Charles, Mo., succeeds *Allen W. Clarke*, who has retired after 46 continuous years of service.

Mr. Euwer, a graduate of Pennsylvania State College, entered ACF's service in 1929 at St. Charles as assistant mechanical engineer, specializing in passenger-car work. In 1947 he became assistant chief engineer, passenger cars.

Mr. Clarke's career since graduating from Purdue in 1907 has covered the transition in railroad passenger cars from wood to steel and from steel to streamline alloy construction. He was a draftsman at the old AEC-Jeffersonville plant and served in St. Louis, New York and Berwick before becoming assistant general mechanical engineer at St. Charles. He became chief engineer, passenger cars, in 1948.

■

COLUMBIA MACHINERY & ENGINEERING CORP.—The Columbia Machinery & Engineering Corp. has acquired all assets and manufacturing rights of the *Bridgeport Safety Emery Wheel Company*, Bridgeport, Conn., and the *Diamond Machine Company*, Stratford, Conn.

■

MINNESOTA MINING & MANUFACTURING CO.—*Paul D. Howard*, has been appointed national supervisor of railroad transportation trades for the reflective products division of the Minnesota Mining & Manufacturing Co., St. Paul.

■

BAKER-RAULANG COMPANY.—The Baker-Raulang Company, Cleveland, has purchased the *Lull Manufacturing Corporation*, Minneapolis, to be operated as a wholly owned subsidiary under the name Baker-Lull Corporation.

Edmund C. Horman has been appointed regional sales manager for the Baker-Raulang Company in the New York metropolitan area.

■

LIBBY-OWENS-FORD GLASS COMPANY.—Libby-Owens-Ford has appointed *Silvercote Products, Inc.*, 161 East Erie street, Chicago, sales distributor for fabricated superfine fiber-glass materials to the railroad industry.

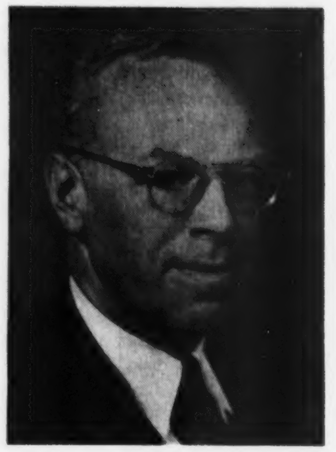
■

RUST-OLEUM CORPORATION.—*Thomas S. Walsh* has been appointed factory representative of the Rust-Oleum Corporation for the metropolitan New York and northern New Jersey trade area.

Obituaries

WILLIAM M. RYAN, retired president of the Ryan Car Company, died on January 3 at Chicago.

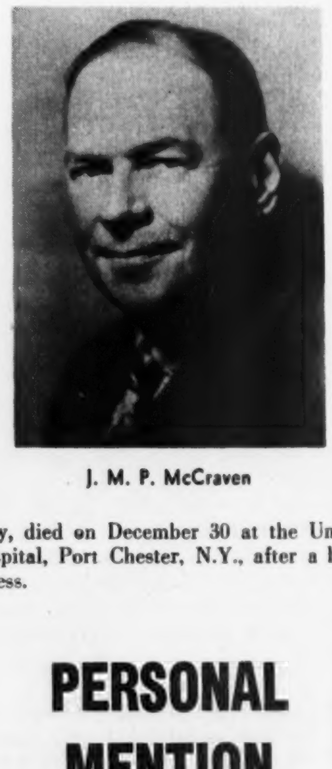
BASIL S. CAIN, assistant manager of locomotive engineering at the locomotive and car equipment department of the General Electric Company at Erie, Pa., died of a heart attack on January 5. Mr. Cain was born in Manchester, England, October 8, 1899. He began his engineering career as a student apprentice in 1921 with the British Thompson-Houston Company, an English affiliate of General Electric. He



Basil S. Cain

came to the United States in 1923 with the company's International General Electric division, and was appointed assistant manager of locomotive engineering in 1936.

J. M. P. McCraven, manager of the railway sales department of the Texas Company, died on December 30 at the United Hospital, Port Chester, N.Y., after a brief illness.



J. M. P. McCraven

PERSONAL MENTION

Chicago, Burlington & Quincy

Henry H. Urbach, general superintendent motive power and machinery, appointed assistant vice-president—mechanical operations.

Born: February 4, 1890, at Sutton, Neb.
Education: High school.
Career: Became machinist apprentice on Burlington at Havelock, Neb., in February 1907. In July 1912 became machinist at Havelock; in July 1914, machinist at Edgemont, S. D.; in April 1915, roundhouse foreman at Seneca, Neb.; in March 1917, roundhouse foreman at Alliance, Neb.; in November 1917, general foreman at Edge-

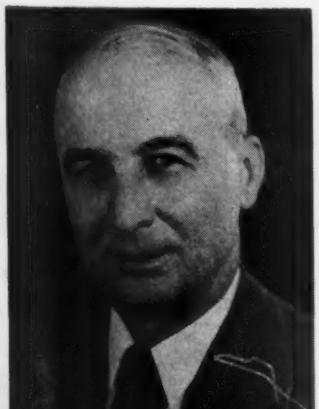
mont; in December 1918, general foreman at Alliance; in October 1920, general foreman at Denver; in May 1923, assistant master mehcanic at Galesburg, N.D.; in September 1923, master mechanic at Brookfield, Mo.; in October 1925, master mechanic at McCook, Neb.; in August 1926, assistant superintendent motive power, Chicago; in March 1927, superintendent motive power, Havelock. Appointed mechanical assistant to vice-president in May 1936, and general superintendent motive power and machinery of Burlington, Colorado & Southern and Fort Worth & Denver City in March 1948.

Henry H. Urbach

Clubs: Past president Western Railway Club.

Charles E. Melker, superintendent of motive power, appointed general superintendent motive power of the Burlington and the Colorado & Southern at Chicago, as announced in the February issue.

Career: Began as a machinist apprentice on the Burlington at Lincoln, Neb., in 1907. Became machinist in 1912; night roundhouse foreman in 1916, and later foreman at Ravenna, Neb. Appointed foreman at Hastings, Neb., in 1918; roundhouse foreman in 1919, and later the same year general foreman at Greybull, Wyo. Became master mechanic at Casper, Wyo., in 1920; master mechanic at Hannibal, Mo., in 1930, and superintendent of motive power in 1936.



C. E. Melker

Chesapeake & Ohio

W. C. Cox, electrical engineer, Pere Marquette district, at Grand Rapids, has retired, as announced in January.

Career: Entered railway service in 1914 with the Pere Marquette as an electrician. In 1915 became car-lighting engineer at Bay City, Mich. and in 1918 electrical foreman. Six months later became powerhouse engineer and in 1950 electrical engineer.

C. W. Nelson, electrical engineer at Richmond, Va. has retired.

Born: Copenhagen, Denmark, December 23, 1887.

Career: Began as a clerk in the stores department of the Pullman Company. Later served intermittently in various capacities in the electrical departments of the C&O and the Pullman Company. Appointed supervisor of train control of the C&O in May 1923; supervisor of train control and train lighting in May 1929, and electrical engineer in June 1938.

Denver & Rio Grande Western

Paul D. Starr, master mechanic at Grand Junction, Col., appointed superintendent of diesel equipment.

ROBERT L. JACOBSEN, special apprentice at Burnham (Denver) shops, appointed mechanical engineer.

J. K. PETERS, mechanical engineer, appointed assistant to chief mechanical officer.

Erie

MATHEW L. LARKIN, assistant engineer of tests, appointed chief chemist in the testing laboratories at Meadville, Pa.

HEINZ P. ZYDOR, office engineer for mechanical department, appointed supervisor of machinery and tools, with headquarters at Cleveland.

CONRAD F. MCKINNEY, supervisor of machinery and tools at Cleveland, has retired.

Long Island

PALMER S. MOCK, superintendent motive power, appointed acting superintendent entire road.

J. J. ORTLIEB, motive power engineer, appointed acting superintendent of motive power.

Louisville & Nashville

J. PAGE WALKER appointed assistant mechanical engineer at South Louisville. Ky.

New York Central

J. J. LARSON appointed superintendent of East Buffalo car shop.

H. C. HAUPT appointed general car inspector, with headquarters in New York.

HERBERT W. FAUS, engineer locomotive equipment, system, at New York, has retired.

Born: July 28, 1886, in Muncy Valley, Pa.

Education: Dickinson Preparatory School (1906) and Syracuse University (C.E. 1910).

Career: From 1901 through 1904 clerical worker Lehigh Valley Coal Company, Snow Shoe, Pa. Summer vacations 1905 through 1909 employed as colliery clerk and in mine surveying for the Lehigh company and the Pennsylvania Coal & Coke Co. Became rodman and transitman on construction of Toronto-Ottawa line of Canadian Northern. Successively bridge inspector and bridge engineer in charge of construction of all bridges on Divisions 1 and 2, east of Vancouver, B.C., Canadian Northern now the main line of Canadian National. Appointed resident engineer of the Canadian Pacific in 1913. In 1915 became associated with the New York Central as special engineer, office of assistant to president, at New York. From 1917-1923 was with the U.S. Shipping Board Emergency Fleet Corporation, successively as office engineer, plant engineer, resident engineer, and chief administrative officer at Bristol Shipyard Plant on Delaware River. Returned to the N.Y.C. in 1923 as special engineer, office of chief engineer motive power and rolling stock. Appointed engineer of tests in 1925 and from 1937 through 1953 was, successively, engineer motive power and engineer locomotive equipment, responsible for design and construction of new steam locomotives and engineering standards of locomotive maintenance. Holds license as professional engineer, New York State.

Clubs and Associations: Associate member Canadian Society of Civil Engineers; member American Society of Mechanical Engineers, Life member Mechanical Division, Association of American Railroads, of which he is chairman, Sub-Committee on Draft Gears; chairman, Committee on

H. W. Faus

Couplers and Draft gears, and chairman, Joint Sub-Committee on Side Frames and Bolsters. American Society of Testing Materials (1928-37, chairman, Committee on Wrought Iron; 1932-37, vice-chairman, Committee on Steel; 1928-37, chairman various sub-committees.) American Standards Association (representative of A.A.R. and member of various committees for two years.) Locomotive Maintenance Officers' Association; Master Boilermakers' Association; New York Railroad Club.

CECIL A. GUHL appointed general foreman at Fearing street, Toledo.

ERNST E. BRADLEY, general foreman at Riverside, Ohio, appointed assistant master mechanic at Indianapolis.

W. S. H. HAMILTON, engineer, electrical equipment, appointed engineer, locomotive equipment, with headquarters at New York.

BERT L. STROHL, assistant master mechanic at Indianapolis, appointed master mechanic at Bellefontaine, Ohio.

PAUL P. LADOW appointed general foreman at Elkhart, Ind.

Norfolk & Western

H. C. WYATT, assistant general superintendent motive power, made vice-president and general manager.

C. E POND, assistant superintendent motive power—car, appointed superintendent motive power, a new position.

C. S. PATTON, JR., assistant to the superintendent motive power, apponted assistant superintendent motive power—car.

ROBERT M. STICKLEY, JR., general foreman, locomotive department, appointed assistant to the superintendent motive power.

JOHN A. GEARHART, general foreman—foundry, appointed general foreman, locomotive department.

WILLIAM R. KINSEY, assistant general foreman—foundries, appointed general foreman—foundry.

JOSEPH L. STONE, foreman—pattern shop, appointed assistant general foreman—foundries.

G. A. BUCK appointed foreman, pattern shop.

New Devices

(Continued from page 122)

Dry Chemical Fire Fighter

A one-man fire engine with a discharge capacity of 150 lb. dry chemical compound has been introduced by American-La France Foamite Corporation, Elmira, N. Y. Known as the Model 150, it is 480 lb. in weight, fully charged, and mounted on large diameter wheels for portability.

The device carries the approval label of Underwriters' Laboratories, with class B and C classification. Its expellent is dry nitrogen, with sustained operating pressure of 200 psi. during the period of discharge. All contents can be discharged in 45 sec., if necessary. The nozzle lever has a spring loaded mechanism which permits opening or closing the nozzle as desired.

■

Electrical Insulating Compound

A putty-like electrical insulating compound that comes in a convenient roll and applies like tape has been announced by Minnesota Mining and Manufacturing Company, 900 Fauquier Street, St. Paul, Minn.

Designated "Scotchfil" brand electrical insulation putty, the black ⅛-in. thick material fuses into a void-free mass after application. It is designed not only to insulate, but also to pad sharp edges as on bus bars, build up cable splices, and fill voids around irregular-shaped connectors prior to taping.

Since it comes in roll form, it is necessary to use only as much as is needed for

the job, and the rest of the roll is protected by a disposable liner. As the material is used, the liner is stripped off, and the insulating putty is molded into place with the fingers, providing a smooth, non-sticky, easy-to-tape surface that does not smear or come off on the hands.

It is used with Scotch brand plastic electrical tapes Nos. 22 and 33 since the backing and adhesive of these tapes form a bond with the material, adding to the mechanical strength of the splice.

Aging characteristics of the material are described as excellent and the manufacturer states it will not dry out or become hard and brittle.

It has a dielectric strength of 350 volts per mil, an insulation resistance of 100,000 megohms, and will not corrode copper or silver. It is supplied in rolls of 1½ in. wide and 5 ft. long.

Neoprene Tape

Bi-Prene, a self-affixing neoprene electrical insulating tape has been announced by the Bishop Manufacturing Corporation, 138 Factory Street, Cedar Grove, N. J.

This easy-to-apply tape provides a splicing medium with a high degree of oil and solvent resistance, when vulcanized, plus high dielectric strength and aging qualities. It conforms to irregular surfaces when wrapped under normal taping tension, and may be cured in a field or factory patching press to produce a smooth, good-looking splice. The curing time is directly related to the depth of the splice section and the mold temperature. In most applications, the curing process can be accomplished in a matter of minutes, and at temperatures not exceeding 310 deg. F.

Bi-Prene is available in 30-ft. rolls, .030 in. thick, in standard widths of ½, ¾, 1, 1½ and 2 in. In addition to tape form, Bi-Prene compounds can be furnished in bulk on special order. Other neoprene compounds can be supplied to specification.

Dynel Fabric Work Clothes

Suited to industrial jobs involving use of acids or caustics because the fabric resists corrosive chemicals, as well as wear, moths, mildew, shrinkage, snagging and tearing is a line of shirts, trousers and coveralls, called MSA ChemKlos.

These work clothes, made of Dynel fabric, now are available in a shade of grey which is said to make strains and soil less noticeable, and to make laundering easier. They are available from Mine Safety Appliance Company, Pittsburgh 8.

Other additions to the line are a lightweight shirt of 6 oz. material rather than 8 oz., but identical in material and weave and six more units in sizes 38 to 48, for men over six ft. in height, in addition to 13 standard sizes.